# Results of the 2005 TMDL monitoring for Diazinon and Chlorpyrifos in California's Central Valley Waterways

## January - February 2005

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## Introduction

This report describes the pesticide monitoring results, including the loads of diazinon and chlorpyrifos, at nineteen locations (Figures 1-3) in fifteen waterways of California's Central Valley associated with runoff events that occurred in January and February 2005. The monitoring was conducted by the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB). For the purposes of this report a "storm event" is defined as the period of time encompassed by sample collection, and over which pesticide loads were assumed to have occurred.

## Objective

The primary objective of this project was to monitor nineteen selected sites (Table 1) in the Sacramento and San Joaquin River Basins, and the Sacramento-San Joaquin Delta over two winter storm events during the 2004-2005 orchard dormant spray season to further characterize and define the sources of diazinon, chlorpyrifos and other organophosphates that cause surface water contamination and toxic conditions to aquatic life. The results of this study will be used to support the implementation of the Total Maximum Daily Load (TMDL) for diazinon in the Sacramento and Feather Rivers, and the development of diazinon and chlorpyrifos TMDL's in the Sacramento, Sacramento-San Joaquin Delta, and San Joaquin River Basins.

## Monitoring Overview

In the Sacramento Basin six sites were monitored once daily, for eleven to twelve days each, over the course of two consecutive storm events from 15-26 February 2005. In the San Joaquin Basin six sites were monitored either once or twice per day during and following two separate storm events: 27-30 January and 15-18 February 2005. In the Delta seven sites were monitored once daily during and following one storm event from 15-19 February 2005 (Table 1).

The measured field parameters included pH, water temperature, electrical conductivity (EC), and stream discharge at non-tidally influenced and non-gauged sites. All water samples were delivered to the California Department of Food and Agriculture

(CDFA) laboratory in Sacramento, California for chemical analysis using gas chromatography (GC) and mass spectrometry (MS).

The detection frequency, concentrations and calculated instantaneous loads for diazinon and chlorpyrifos are presented in this report. The CDFA laboratory analyzed 12 chemical compounds for each water sample. The chemical analysis results obtained from the laboratory and parameters measured in the field are presented in tabular format on a compact disc appended to this report.

**Figure 1.** The six sampling sites in the Sacramento Basin monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

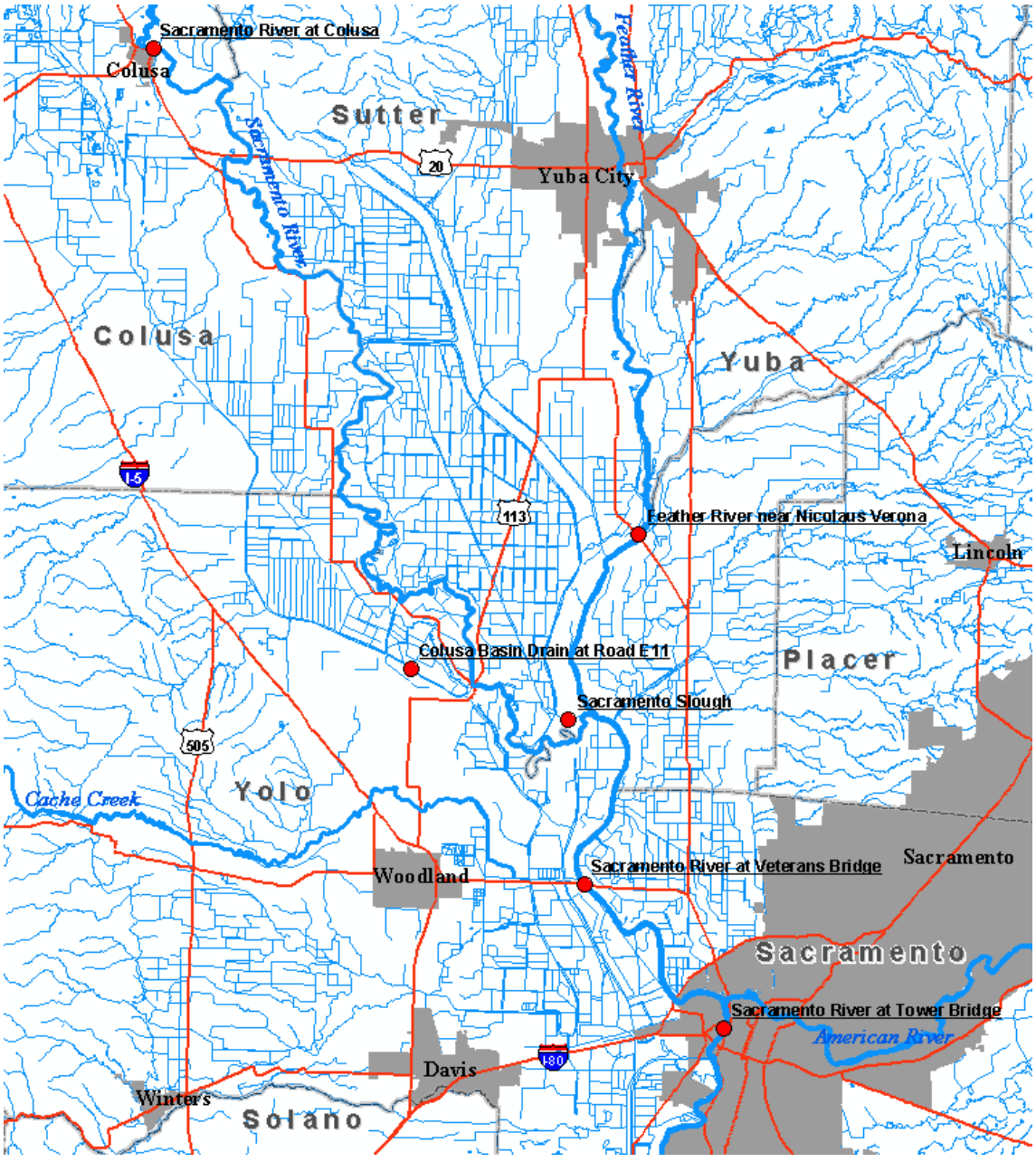


**Figure 2.** The six sampling sites in the San Joaquin Basin monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

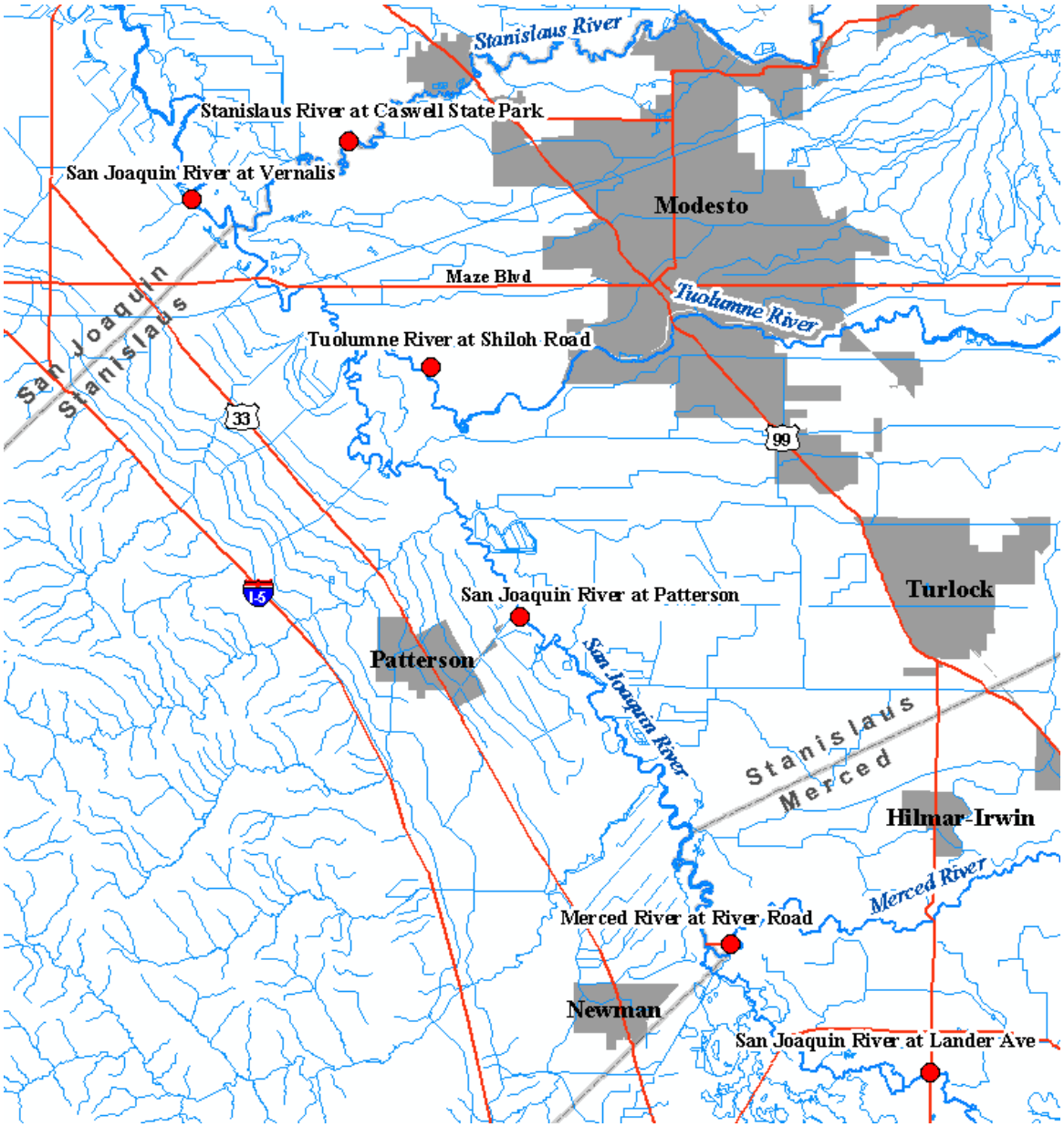


**Figure 3.** The seven sampling sites in the Sacramento – San Joaquin Delta monitored for organophosphate pesticides during the orchard dormant spray season 2004-05.

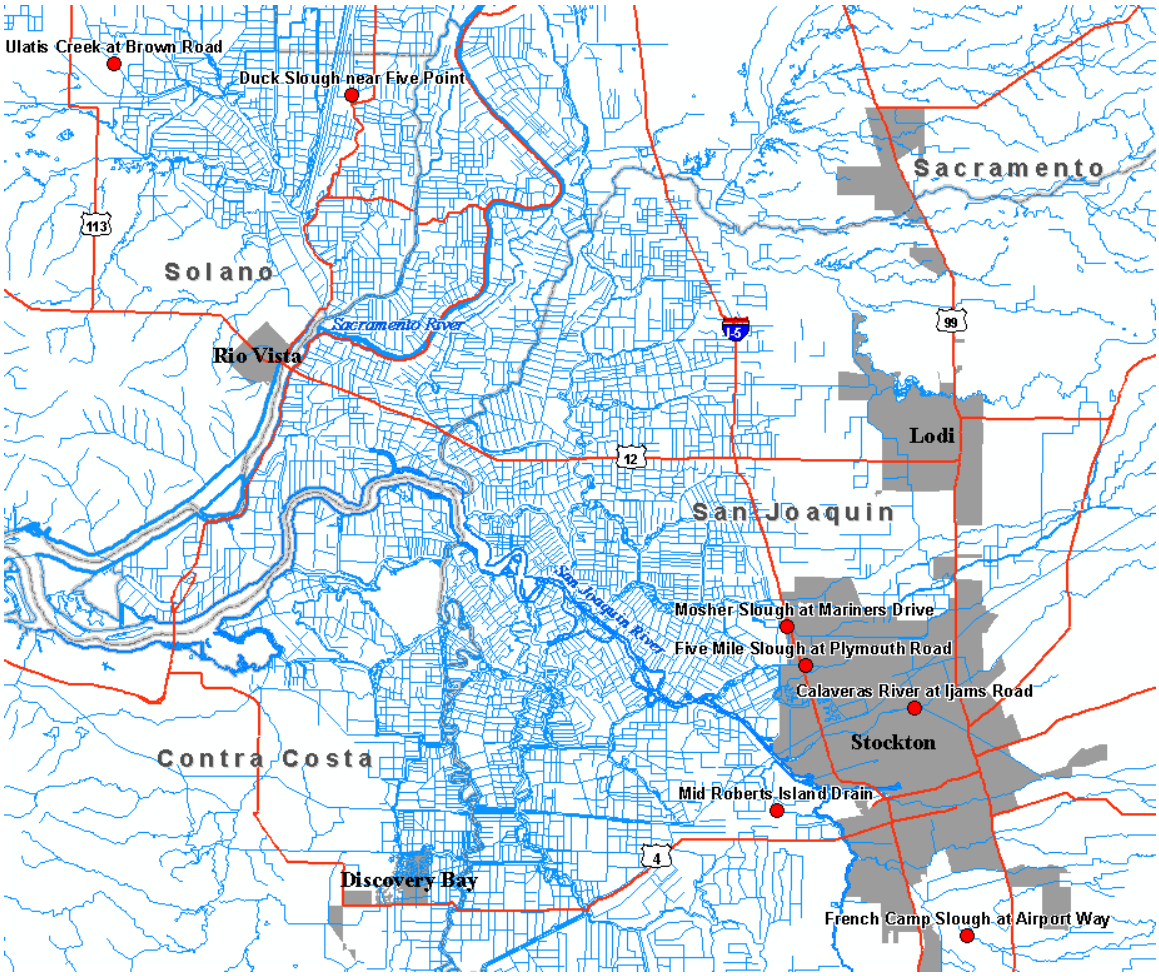


**Table 1.** Sampling sites, scheduled sampling frequency for each storm event and actual storm event sampling dates for the Sacramento, Delta and San Joaquin sampling sites.

| **Sacramento Sampling Sites** | **Scheduled sampling frequency** | **Actual storm event sampling dates** |
|---|---|---|
| Colusa Basin Drain near Knights Landing | 1 sample/day x 7 days | Feb 15 – Feb 25, 2005 |
| Sacramento River at Veterans Bridge | 1 sample/day x 8 days | Feb 16 – Feb 25, 2005 |
| Feather River near Nicolaus / Verona | 1 sample/day x 7 days | Feb 16 – Feb 25, 2005 |
| Sacramento River at Tower Bridge | 1 sample/day x 8 days | Feb 15 – Feb 26, 2005 |
| Sacramento River at Colusa | 1 sample/day x 7 days | Feb 15 – Feb 25, 2005 |
| Sacramento Slough | 1 sample/day x 8 days | Feb 16 – Feb 26, 2005 |
| **Delta Sampling Sites** | **Scheduled sampling frequency** | **Actual storm event sampling dates** |
| Mosher Slough at Mariner's Drive | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| Five-mile Slough at Plymouth Road | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| Calaveras River at Ijams Road | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| Mid-Roberts Island Drain | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| French Camp Slough at Airport Way | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| Ulatis Creek at Brown Road | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| Duck Slough | 1 sample/day x 5 days | Feb 15 – Feb 19, 2005 |
| **San Joaquin River Basin Sampling Sites** | **Scheduled sampling frequency** | **Actual storm event sampling dates** |
| San Joaquin River at Vernalis | 2 samples/day x 4 days storm events 1 through 3 | Jan 27 – Jan 30, 2005<br>Feb 15 – Feb 18, 2005 |
| Stanislaus River at CSP | 2 samples/day x 4 days storm events 1 through 3 | Jan 27 – Jan 30, 2005<br>Feb 15 – Feb 18, 2005 |
| Tuolumne River at Shilo Road | 2 samples/day x 4 days storm events 1 through 3 | Jan 27 – Jan 30, 2005<br>Feb 15 – Feb 18, 2005 |
| San Joaquin River at Lander Avenue | 1 sample/day x 4 days storm event 1 only | Jan 27 – Jan 30, 2005 |
| San Joaquin River at Patterson | 1 sample/day x 4 days storm events 2 and 3 only | Feb 15 – Feb 18, 2005 |
| Merced River at River Road | 1 sample/day x 4 days storm events 1 through 3 | Jan 27 – Jan 30, 2005<br>Feb 15 – Feb 18, 2005 |

**Precipitation During the Study**

The following summary includes rain gage data obtained through the website www.weatherunderground.com and weather updates from State Climatologist Bill Mork.

Two storm events were sampled in the northern San Joaquin basin, one storm event was sampled in the Delta basin and two consecutive storm events were sampled in the Sacramento basin.

In the Sacramento basin four weather-monitoring stations were used: Red Bluff and Sacramento representing precipitation in the Sacramento River basin, and Oroville and Marysville, representing precipitation in the Feather River basin. In the San Joaquin Valley, a weather monitoring station located in downtown Modesto was used to record rainfall. In the Delta basin, two weather-monitoring stations were used: Stockton and Fairfield.

The first storm event sampled in the San Joaquin region was preceded by a dry period of 14 days, and began on 26 January with 0.41" of rain recorded in Modesto, 0.01" on 27 January and 0.69" on 28 January (Figure 4). Sampling commenced on 27 January and continued for a period of four days. This storm event was characterized as a progressive Pacific upper air pattern that brought precipitation in a series of weather systems to Northern California (Mork, personal communication).

A second major storm event began on 14 February and was preceded by a 15 to 17 day dry period throughout the northern Central Valley. Sampling began in all study regions on 15 February. This storm event was characterized by a broad subtropical flow bringing moisture from the south, northward across California, with the Jet Stream providing additional impulses of shortwave energy that produced recurring periods of precipitation throughout the study regions (Mork, personal communication).

In the San Joaquin basin the second storm event began on 14 February with 0.16" of rain, increasing to 1.1" on 15 February, and falling to 0.16" on 16 February (Figure 4). Sampling commenced on 15 February and continued for a period of four days.

On 14 February, 0.28" and 0.23" of rain fell in Stockton and Fairfield, respectively. On 15 February, these amounts increased to 0.75" (Stockton) and 1.43" (Fairfield), with precipitation decreasing to less than 0.3" at both locations on each of the following two days (Figure 5). Sampling began on 15 February and continued for a period of four days.

On 13 February in Red Bluff, 0.47" of rain fell. On 15 February rain fell at all monitoring stations and ranged from 0.16" at Oroville to 0.7" at Sacramento (Figure 6).

Over the next seven days rain fell in various amounts at different stations. On 16 February precipitation amounted to 0.54" at Marysville and 0.37" at Oroville. During 17-18 February, precipitation decreased significantly, until 19 February when all stations recorded rainfall with values ranging from 0.22" at Sacramento to 0.61" at Red Bluff. Significant rain fell again on 21 February with 0.48" at Oroville and 0.42" at Marysville (Figure 6). As a result of these continuing precipitation events, sampling in the Sacramento basin was extended past the original eight-day schedule and concluded on 26 February, a period of 12 days.

**Figure 4.** Rainfall at Modesto, California during the 2004-05 dormant spray season.

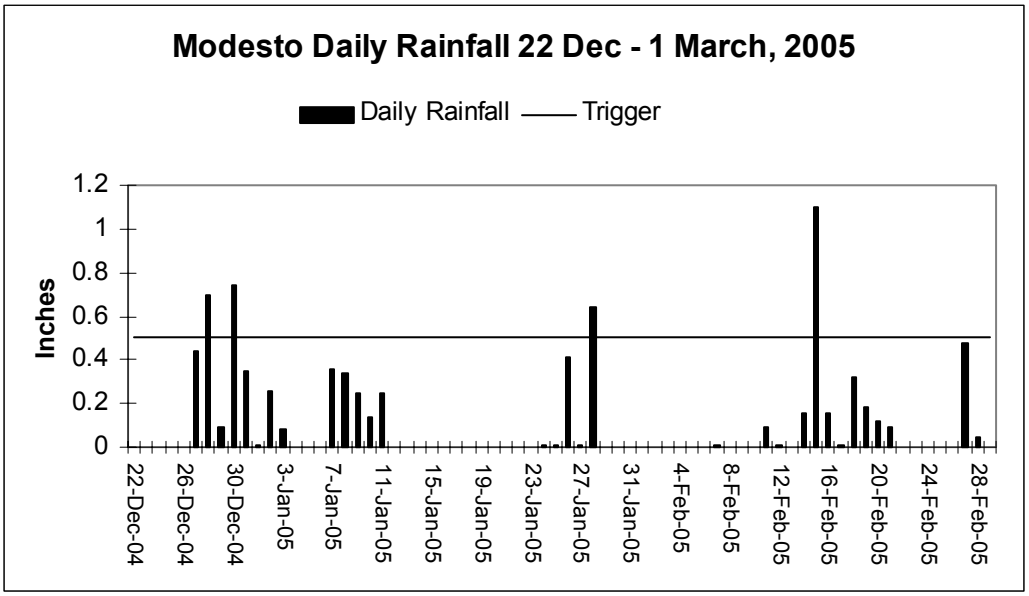
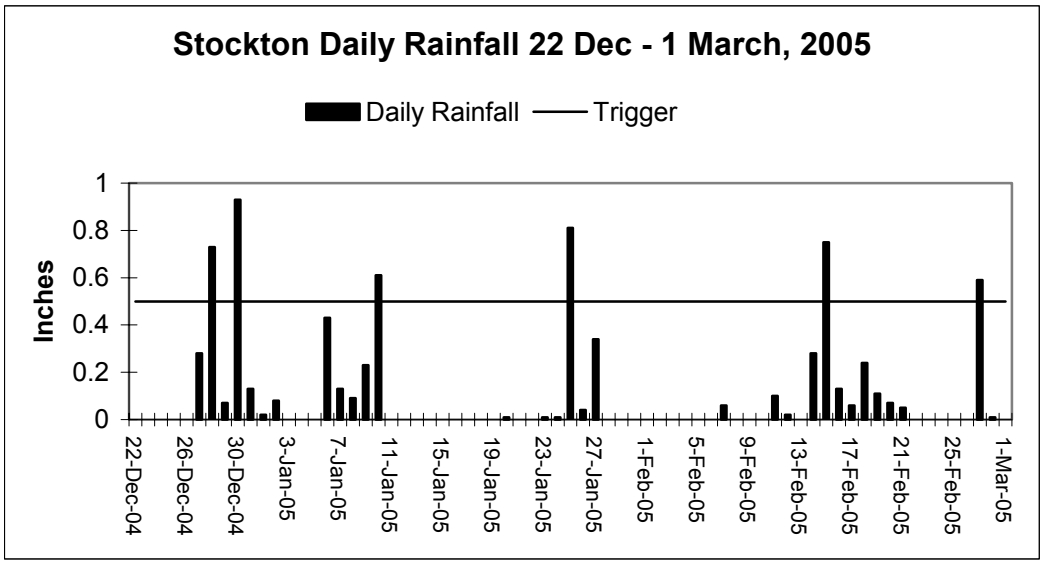


**Figure 5.** Rainfall at Stockton and Fairfield, California during the 2004-05 dormant spray season.



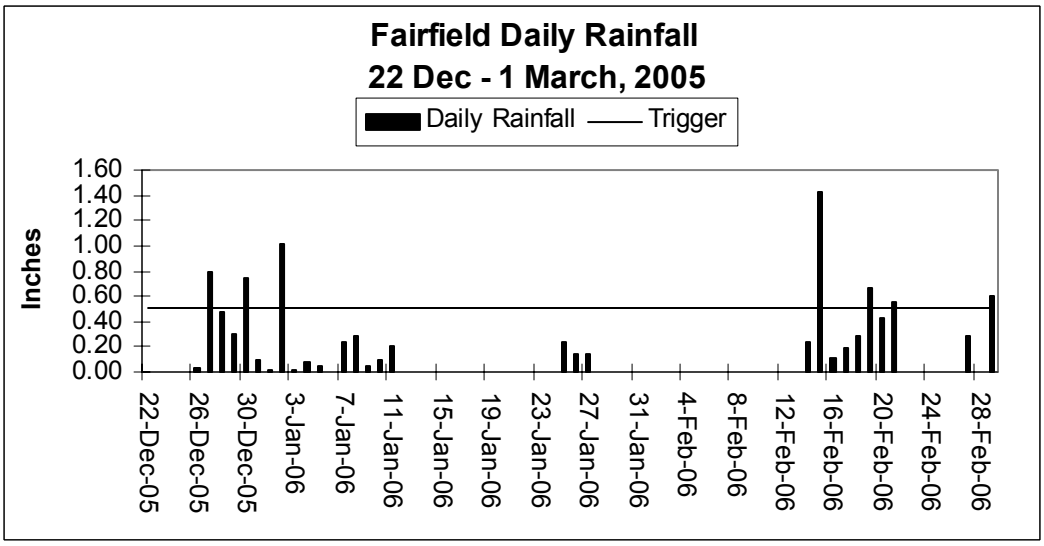
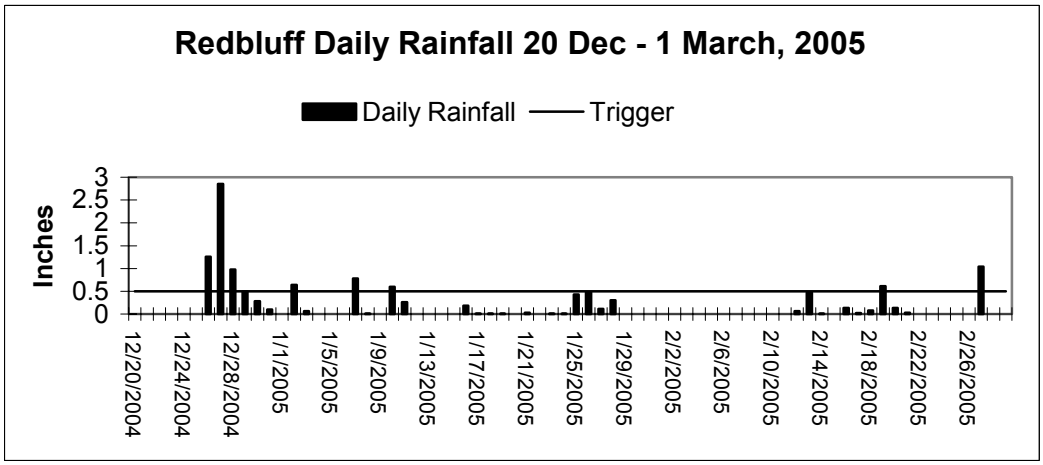
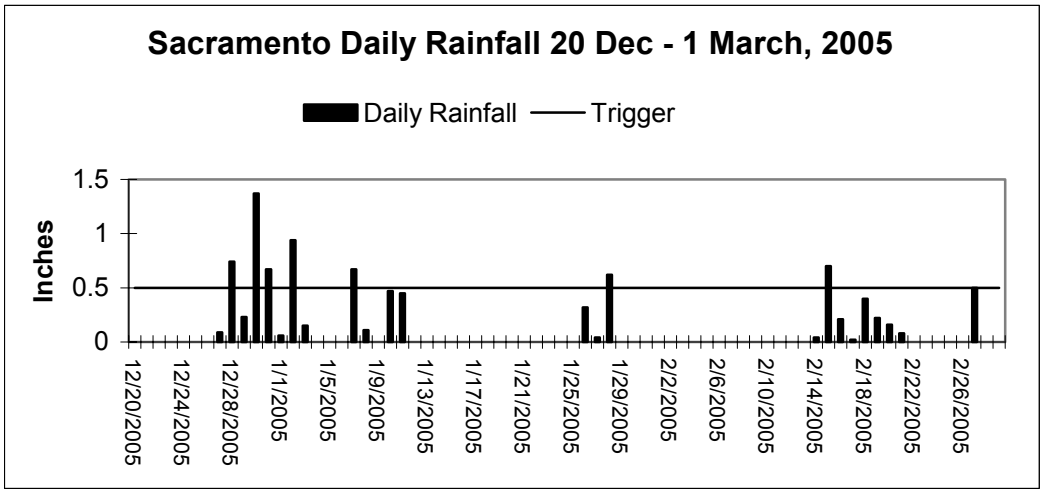




**Figure 6.** Rainfall at Red Bluff, Sacramento, Marysville and Oroville, California during the 2004-05 dormant spray season.




Sacramento Daily Rainfall 20 Dec - 1 March, 2005
Daily Rainfall
Trigger
Inches
1.5
1
0.5
0
12/20/2005
12/24/2005
12/28/2005
1/1/2005
1/5/2005
1/9/2005
1/13/2005
1/17/2005
1/21/2005
1/25/2005
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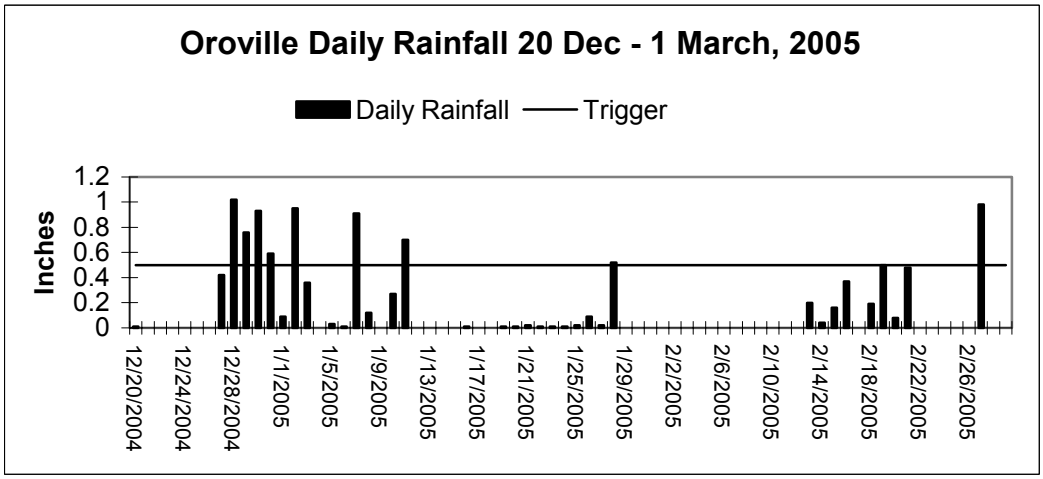
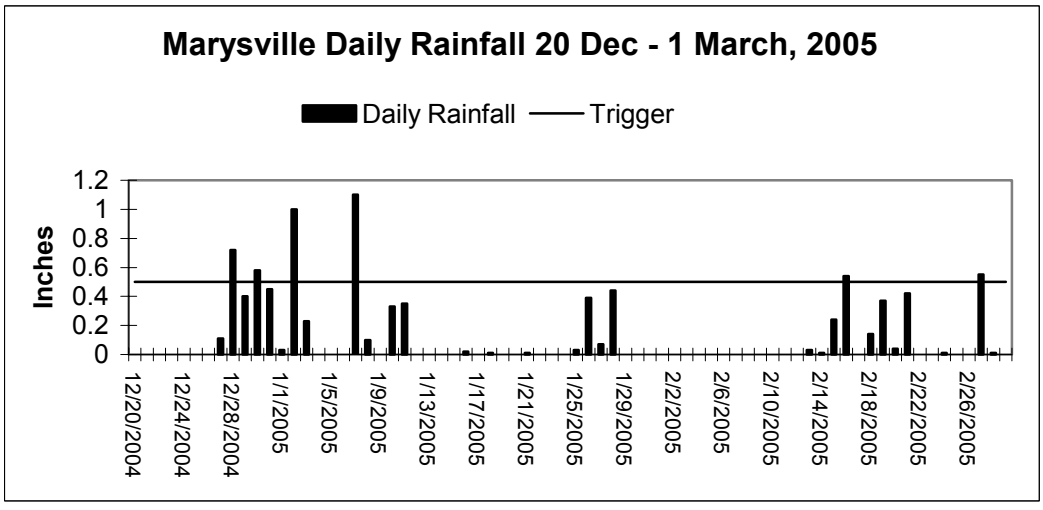
2/6/2005
2/10/2005
2/14/2005
2/18/2005
2/22/2005
2/26/2005


Oroville Daily Rainfall 20 Dec - 1 March, 2005
Daily Rainfall
Trigger
Inches
1.2
1
0.8
0.6
0.4
0.2
0
12/20/2004
12/24/2004
12/28/2004
1/1/2005
1/5/2005
1/9/2005
1/13/2005
1/17/2005
1/21/2005
1/25/2005
1/29/2005
2/2/2005
2/6/2005
2/10/2005
2/14/2005
2/18/2005
2/22/2005
2/26/2005


Marysville Daily Rainfall 20 Dec - 1 March, 2005
Daily Rainfall
Trigger
Inches
1.2
1
0.8
0.6
0.4
0.2
0
12/20/2004
12/24/2004
12/28/2004
1/1/2005
1/5/2005
1/9/2005
1/13/2005
1/17/2005
1/21/2005
1/25/2005
1/29/2005
2/2/2005
2/6/2005
2/10/2005
2/14/2005
2/18/2005
2/22/2005
2/26/2005

**Sample Collection Methods**

All samples were collected by one of the following three methods: grab, integrated grab and Equal Width Interval (EWI). The collection method used for each site is shown in Table 2.

Grab samples were collected by harnessing a 1-liter amber glass bottle into a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible.

Integrated grab samples were collected by lowering a 3-liter PTFE (polytetrafluoroethylene) bottle, strapped in a weighted cage, from a bridge at three equally spaced verticals. At each vertical the bottle was filled approximately ¼ full. The composite sample was then thoroughly agitated and poured into a 1-liter amber glass sample bottle. The PTFE bottles were used at all sites to minimize loss of pesticide due to sorption to container walls.

EWI samples were collected at 6-10 equally spaced points across the channel width with a U.S. Geological Survey (USGS) D-77 sampler using the equal-width-increment method. (Shelton, 1994). The water from each point (vertical) was mixed in a stainless steel churn, thoroughly agitated then poured into the 1-L glass sample bottle.

At each Sacramento site an additional sample was collected in a 250ml amber glass bottle at the same time that the primary sample was collected and using the same methods. These samples were analyzed for diazinon on a daily basis using Enzyme-Linked Immunosorbent Assay (ELISA). The ELISA analysis provided an inexpensive screen for diazinon and was used to determine if scheduled sampling should be discontinued. ELISA screening began for samples collected on 15 February and continued through the 24 February samples due to their results indicating the continued presence of diazinon at all sites on each day.

In the Delta all samples were collected by the grab method described above.

In the San Joaquin Basin all samples were collected with a 3-liter teflon bottle using the methods outlined above.

Immediately after collection, sample bottles were placed on ice and delivered to the California Department of Food and Agriculture (CDFA) Center for Analytical Chemistry in Sacramento. Samples were usually delivered on the same day and no later than 48 hours after collection.

**Quality Control Samples**

Quality control (QC) samples were collected at the rate of 15 QCs for every 100 environmental samples. Quality control samples included field duplicates, field blanks, equipment blanks, and matrix spikes.

All field duplicate samples collected in the Delta and San Joaquin basins were split duplicates. In the Sacramento basin both split duplicate and sequential duplicate samples were collected. Water collected for split duplicate samples using the 3-liter Teflon bottle was poured into two 1-liter bottles. Sequential duplicate samples were collected immediately after collecting the primary sample by repeating the method (3L PTFE or D77) used to collect the primary sample. For split duplicate samples collected using a 1-liter bottle, two bottles were attached to the pole sampler and filled at the same time.

Field blanks were filled with organic-free (deionized) water obtained from the AEAL laboratory. When using the 3-liter bottle for sampling, the cleaned bottle was filled with organic-free water, which was then poured into a 1-liter bottle as a field blank. When using the 1-liter bottle, a cleaned bottle was filled with the organic-free water directly.

The equipment blanks were collected one time only for each piece of sampling equipment (e.g. pole sampler, 3-liter PTFE bottle, stainless steel churn). The equipment was cleaned according to the standard cleaning procedure, as described in the quality assurance project plan (QAPP) (Calanchini, 2005), and then rinsed with organic-free water. The rinse water was collected in a 1-liter for analysis.

The matrix spike samples were collected in the same manner as the split duplicate samples. The spike mixture was added to the matrix spike samples in the CDFA lab. All field samples, including QC samples, were placed into a cooler with ice to maintain the temperature at approximately 4°C during handling and transport to the lab. In general, samples were delivered under chain-of-custody (COC) protocol (QAPP) to the lab on the sampling day. If the samples could not be transported to the lab on the sampling day they were stored in coolers with sufficient ice to maintain the sample preservation temperature and delivered to the lab on the following day.

**Table 2.** Sampling sites, sampling methods and source for determining discharge, Sacramento River Basin, California.

[Integrated= integrated grab sample with 3L PTFE bottle; ADCP, acoustic Doppler current profiler; manual discharge measurements made with Price Type AA current meter, sounding reel and bridgeboard]

| **Sacramento Sampling Sites** | **Sampling Method** | **Source of Discharge Data** |
|---|---|---|
| Colusa Basin Drain near Knights Landing | Integrated (Bridge) | Manual discharge |
| Sacramento River at Veterans Bridge | EWI / Boat | ADCP or CDEC gage: VON |
| Feather River near Nicolaus / Verona | EWI / Boat | ADCP or CDEC gage: NIC |
| Sacramento River at Tower Bridge | EWI / Bridge | CDEC gage: IST |
| Sacramento River at Colusa | Integrated (Bridge) | CDEC gage: COL |
| Sacramento Slough | EWI / Boat | ADCP |
| **Delta Sampling Sites** | **Sampling Method** | **Source of Discharge Data** |
| Mosher Slough at Mariner's Drive | Grab/Bank | None |
| Five-mile Slough at Plymouth Road | Grab/Bank | None |
| Calaveras River at Ijams Road | Grab/Bank | Manual discharge |
| Mid-Roberts Island Drain | Grab/Bank | None |
| French Camp Slough at Airport Way | Grab/Bank | None |
| Ulatis Creek at Brown Road | Grab/Bank | Manual discharge |
| Duck Slough | Grab/Bank | None |
| **San Joaquin River Basin Sampling Sites** | **Sampling Method** | **Source of Discharge Data** |
| San Joaquin River at Vernalis | Integrated (Bridge) | CDEC gage: VNS |
| Stanislaus River at CSP | Grab/Bank | CDEC gage: RIP |
| Tuolomne River at Shilo Road | Integrated (Bridge) | USGS gage: 11290000 |
| San Joaquin River at Lander Avenue | Grab/Bank | CDEC gage: SJS |
| San Joaquin River at Patterson | Grab/Bank | CDEC gage: SJP |
| Merced River at River Road | Integrated (Bridge) | CDEC gage: MST |

**Discharge Methods and Load Calculations**

The California Data Exchange Center (CDEC) (http://cdec.water.ca.gov/) compiles data from stream gages operated by the USGS, California Department of Water Resources (DWR) and other agencies. At the Sacramento River at Colusa discharge data were obtained from CDEC gage COL located at the sampling site.

An acoustic Doppler current profiler was used from a boat to measure discharge at the Feather River near Nicolaus and Sacramento Slough. Discharge for Sacramento River at Veterans Bridge was received from CDEC gage VON (USGS) approximately 7.7 miles upstream of the sampling site. No tributaries enter the Sacramento River between the gage site and the sampling site. There are three major pumping stations between these sites, however they do not operate during the winter.

Discharge values for the Sacramento River at Tower Bridge were received from the CDEC gage IST located at the I Street Bridge approximately 0.57 miles upstream of the Tower Bridge. There are no tributaries between these sites. For dates when IST was below the rating table and there were no discharge values available, data from CDEC gage FRE on the Sacramento River at Freeport (12.5 miles downstream of IST) were used to estimate discharge [$Q_{IST}$] at IST. The equation [$Q_{IST}$] =0.8321x + 5264.3, ($r^2$=0.96) expresses the relationship between IST and FRE during the study period and was developed using hourly discharge data (n=457) from IST and FRE between 29 December 2004 and 4 March 2005.

At Colusa Basin Drain discharge was measured in conjunction with water collection using a Price Type AA current meter and a USGS bridge board and sounding reel, following standard USGS current-meter methods (Nolan 2001).

In the Delta discharge was measured manually while wading at the Calaveras River and Ulatis Creek using a Swoffer Model 2100 current meter. During high flows a USGS bridgeboard and sounding reel were used in conjunction with the current meter. At French Camp Slough on Airport Way discharge estimates were obtained courtesy of John Tingle at the California Department of Water Resources (CDPR) from the CDPR gage located on site. At Duck Slough and Mid-Roberts Island samples were collected from pumping basins where it was not physically possible to measure discharge. No discharge measurements were made at Mosher Slough and Five-mile Slough. Both of these sites are tidally influenced, with thick mud deposits, making wading access impossible for discharge measurements.

In the San Joaquin Basin discharge data were obtained from gages listed on the CDEC website. The gages for the San Joaquin River at Vernalis (VNS), Lander Avenue (SJS) and Patterson (SJP) are located at the sampling sites.

Discharge for the Stanislaus River at Caswell State Park was obtained from USGS gage 11303000 on the Stanislaus River near Ripon – approximately eight miles upstream of the sampling site. The CDEC data were used unadjusted from the Ripon station. The river flows through an urban area at Ripon and through several urban areas upstream of Ripon.

The CDEC gage MOD (Tuolumne River at Modesto) was used to obtain discharge measurements for the Tuolumne River at Shilo Road sampling site. There are no other suitable gauges for making any kind of distance weighted hydrograph so the data were used as presented on the CDEC website. There are significant urban areas upstream including Modesto and Waterford.

Discharge data for the sampling site on the Merced River at River Road were obtained from the CDEC gage MST (Merced River at Stevinson) approximately 3.68 miles upstream. The discharge gauge elevation is 59 feet and the sample site elevation is 53 feet. The low gradient (6 feet over 3.68 miles) and the size of the river allow us to make the assumption that the river rises fairly uniformly under normal precipitation conditions, therefore, flow data were used unadjusted from the CDEC site. There is one semi-permanent stream between the sample site and the discharge gauge. Flows are unknown for this stream and were assumed to be negligible. The river flows through an urban area near Livingston about 20 miles upstream from the sample site. **[DM1]**

Instantaneous loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection with the measured concentrations of each pesticide times the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available.

**Laboratory Analysis Methods**

Upon arrival at the CDFA laboratory, samples were weighed and filtered using 0.45µ filter paper. Each sample was spiked with 500µL of 1.0 µg/ml chlorpyrifos methyl (0.5µg/mL) surrogate spiking solution. The entire sample was emptied into a 2-liter size separatory funnel and approximately 10-15g of granular sodium chloride were added. 60ml of methylene chloride were added and the sample was mixed for three minutes. The

organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g). The extraction process was repeated three times and the resultant sample evaporated to 5-7 ml at 40° C, then evaporated to dryness with an N-evaporator. 1.0ml of methylene chloride and 10µL of a 5.0µg/mL internal standard solution were added to each sample. Samples were stored in a –5ºC freezer until analysis. Samples were analyzed with an Agilent Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode.

Twelve compounds were analyzed for each sample (Table 3). The limits of quantitation (LOQ) for diazinon and chlorpyrifos were 20 and 10 parts per billion (ppb), respectively. The detection limits (LOD) were 7 and 4 ppb for diazinon and chlorpyrifos, respectively (Table 3). The lab reported estimated values when the values were below the LOQ but above the LOD. To ensure the accuracy and precision of the sample analysis, lab spikes, blanks, and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

**Table 3.** CDFA Laboratory limits of detection and practical quantitation limits for select pesticides

| Compound | Limit of Detection (LOD in µg/L) | Limit of Quantitation (LOQ in µg/L) |
|---|---|---|
| Azinphos methyl | 0.007 | 0.050 |
| Bifenthrin | 0.007 | 0.050 |
| Carbaryl | 0.007 | 0.020 |
| Chlorpyrifos | 0.004 | 0.010 |
| Cyanazine | 0.007 | 0.050 |
| Dacthal (DCPA) | 0.007 | 0.050 |
| Diazinon | 0.007 | 0.020 |
| EPTC (Eptam) | 0.020 | 0.050 |
| Methidathion | 0.010 | 0.030 |
| Metolachlor | 0.007 | 0.020 |
| Propargite | 0.150 | 0.500 |
| Simazine | 0.005 | 0.200 |

## Results

A total of 164 primary samples (Appendices 1a,b,c & Appendices 4a,b,c) and 41 quality control (QC) samples (Appendices 3a,b,c) were collected and analyzed: 65 primary, 19 QC in the Sacramento basin; 35 primary, 10 QC in the Delta; 64 primary, 12 QC in the San Joaquin basin.

*Primary samples*

Concentrations of diazinon and chlorpyrifos in the Sacramento basin ranged from below detection to 0.410 ppb of diazinon and 0.004 ppb chlorpyrifos (estimated), at Sacramento Slough on 16 and 24 February 2005, respectively (Appendices 1a, b, c).

In the Sacramento basin a second sample was collected at the same time as the primary sample and analyzed using Enzyme-Linked Immunosorbent Assay (ELISA). All samples analyzed with ELISA showed diazinon to be present. Almost one third (17 of 57) of the samples analyzed using both methods showed no detection of diazinon using GCMS.

ELISA results ranged from 0.008 ppb in a sample from the Sacramento River at Colusa on 19 February to 0.410 ppb in a sample from Sacramento Slough on 20 February (Appendix 2). In every sample, the results obtained through ELISA analysis showed higher concentrations of diazinon present in the sample matrix than results obtained using GCMS on the corresponding environmental samples.

In the Delta pesticide concentrations ranged from below detection to 0.460 ppb of diazinon at Ulatis Creek on 16 February, and 0.036 ppb chlorpyrifos at Mosher Slough on 18 February.

In the San Joaquin basin pesticide concentrations ranged from below detection to 0.57 ppb diazinon in the Tuolumne River at Shilo Road on 27 January and 0.054 ppb chlorpyrifos in the Merced River at River Road on 30 January.

Other pesticides detected in samples were Eptam, Carbaryl, Metolachlor, Bifenthrin, Cyan-azine, Dacthal, Methid-athion, and the herbicide Simazine which was detected in 74% of the Sacramento samples and 100% of the Delta and San Joaquin samples (Appendices 4a,b,c).

*Quality Control Samples*

Sample quality control was measured through collection of sequential duplicates (n=13), blanks (n=8), equipment blanks (n=4), matrix spikes (n=9) and matrix spike duplicates (n=7). The matrix spike samples from the San Joaquin and Merced rivers on 27 and 30 January 2005, respectively, do not have corresponding matrix spike duplicates; the lab did not begin splitting matrix spike samples and analyzing a separate portion as a matrix spike duplicate until after the first sampled storm event in the San Joaquin basin.

The relative percent difference (RPD) between environmental and duplicate sample concentrations of chlorpyrifos ranged from 0-46%. The RPD's between

environmental and duplicate sample concentrations of diazinon ranged from 5-22%. The RPD's between matrix spikes and matrix spike duplicates ranged from 0-17% and 0-26% for chlorpyrifos and diazinon, respectively (Appendices 3a, b, c).

The percent recovery of chlorpyrifos and diazinon in the matrix spike samples ranged from 77-98%, and 82-121% respectively.

No analytes were detected in any of the environmental or equipment blanks. A summary of the environmental data is presented in Appendices 1a, b, c.

*Instantaneous loading rates*

Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available. For all samples where pesticide concentrations were below the limit of detection the loading rate was assumed to be zero.

In the Sacramento basin the highest and lowest calculated instantaneous loading rates for detectable concentrations of diazinon were in the Sacramento River at Sacramento and in the Sacramento Slough, respectively. The only calculated instantaneous loading rate for chlorpyrifos in the Sacramento basin was for the Sacramento Slough on 24 February (Appendix 1a).

In the Delta the highest calculated instantaneous loading rates for both diazinon and chlorpyrifos were in Ulatis Creek while the lowest calculated instantaneous loading rates for detectable concentrations of both diazinon and chlorpyrifos were in the Calaveras River (Appendix 1b).

In the San Joaquin Basin the highest and lowest calculated instantaneous loading rates for detectable concentrations of diazinon were in the Tuolumne River at Shilo Road and the Stanislaus River at Caswell State Park, respectively (Appendix 1c). The highest and lowest calculated instantaneous loading rates for detectable concentrations of chlorpyrifos in the San Joaquin basin were in the San Joaquin River at Vernalis and the Stanislaus River at Caswell State Park, respectively (Appendix 1c).

**Quality Assurance Objectives**

The Quality Assurance (QA) objectives are listed in Table 4 below. Five of the 164 primary samples should be viewed as estimates, or biased low, because the surrogate recovery was outside of the QAPP acceptance limits of 80-125% recovery; all were below 80%.

Five of the 41 field QC samples (duplicates, blanks, equipment blanks, matrix spikes and matrix spike duplicates) did not meet the QAPP objective for precision: a matrix spike and matrix spike duplicate collected from the Sacramento River at Veterans Bridge on 19 February 2005 had an RPD of 26%; one of two samples collected from the Calaveras River on 17 February, that were scheduled as a matrix spike and matrix spike duplicate but treated as field duplicates because the analytical lab failed to add spiking solution prior to extraction, had an RPD of 46%; an equipment blank collected on 15 February had low surrogate recovery (66%) and was not re-analyzed due to a laboratory scheduling error. A field blank collected at French Camp Slough on 19 February had low surrogate recovery (74%) during analysis. The sample was diluted by mistake and reanalyzed. The undiluted sample was reanalyzed on 6 April 2005. The re-analyzed sample also had a low (62%) surrogate recovery.

**Table 4.** Field and Laboratory Quality Assurance (QA) Objectives.

| Field QC | Frequency/Number | Acceptance Limits | Results (met QAO/total # of) |
|---|---|---|---|
| Equipment Blanks | One time per each piece of equipment for first event only | Less than Reporting Limit | 4/4 |
| Field Blanks | Approximately 5% | Less than Reporting Limit | 8/8 |
| Cooler Temperature | Measured by analyzing lab at time of delivery | $\leq$ 4° C | 100% |
| Field Duplicate Pairs | 20 | RPD $\leq$ 25% | 12/13 |
| **Laboratory QC** | **Frequency/Number** | **Acceptance Limits** | |
| Method Blank (=Lab Blank) | 1/batch | 80-125%<br>All target analytes below reporting limit | 12/14 |
| Instrument Blank | After any standards | All target analytes below reporting limit | 100% |
| Matrix Spike | Approximately 5% | 70-130 % diazinon; 70-140% chlorpyrifos | 9/9 |
| Matrix Spike Duplicate | Approximately 5% | 70-130 % diazinon; 70-140% chlorpyrifos<br>RPD $\leq$ 25% | 7/7 |
| Lab. Control Sample (=Lab Control Spike) | 1/Batch | 80-125% | 13/14 |
| Surrogates | In all samples and QC | 80-125% | 200/205 |
| Internal Standards | All samples and standards | 50 – 200 % | 100% |

## Assessment of Data Quality

The overall objective for completeness of diazinon and chlorpyrifos data for this project, as described in the QAPP, was 90% for both laboratory and field measurements. The achieved level of completeness for laboratory measurements was 95% (193 of 205 data points) (Appendices 1a,b,c). The achieved level of completeness for field measurements (temperature, electrical conductivity, and pH) was 100%.

The precision of data analysis was measured through a series of field duplicates (n=13) and matrix spike/matrix spike duplicates (n=7). The acceptable level of precision

for diazinon and chlorpyrifos data from this project, as drafted in the QAPP, was a relative percent difference (RPD) of $\pm$ 25% between duplicate samples, and $\pm$ 25% between matrix spike and matrix spike duplicate samples.

All thirteen sets of duplicate samples had RPD's of less than 25% for diazinon. Eleven of the thirteen sets of duplicate samples had RPD's of less than 25% for chlorpyrifos (Appendices 3a,b,c) ; a duplicate sample collected on 2/17/2005 from the Calaveras River at Ijams Road had an RPD of 46%. This sample was scheduled to be collected as a spike but the analyzing laboratory failed to spike the sample prior to extraction. The sample should be viewed as a duplicate.

Six of the seven sets of matrix spike and matrix spike duplicates had RPD's of less than 25% for diazinon. A sample collected on 19 February 2005 from the Sacramento River at Veteran's Bridge had an RPD of 26%. All seven sets of matrix spike and matrix spike duplicates had an RPD of less than 25% for chlorpyrifos (Appendices 3a,b,c).

The data quality objective (DQO) for recovery of diazinon and chlorpyrifos in matrix spike and matrix spike duplicates was 70-130% for diazinon and 70-140% for chlorpyrifos. All spikes met the DQO for recovery. Recoveries ranged from 82-121% for diazinon and 77-98% for chlorpyrifos (Appendices 3a,b,c).

A total of 14 pairs of lab blanks (LB) and lab control spikes (LCS) were analyzed; a rate of one per batch of samples. The DQO acceptance limits for recoveries were 80-125% for both LB and LCS samples.

Twelve of 14 lab blanks were within the acceptable limits of recovery (Appendix 5). A lab blank extracted on 22 February had low surrogate recovery (73%) due to an extraction error of not adding salt to the deionized water used to make the blank. However, all surrogate recoveries in the actual samples associated with the QC set were within the acceptance limits of 80-125%. A lab blank extracted on 22 February for a second batch of samples also had a low surrogate recovery (68%). The re-analysis gave similar results (66% recovery). The lab blank had no detected compounds above the lab limit of detection. The low recovery was probably due to loss during the concentration step of the extraction procedure.

Thirteen of 14 lab control spikes were with the acceptable limits of recovery (Appendix 6). An LCS extracted on 22 February had low surrogate recovery (66%) due to an extraction error of not adding salt to the deionized water used to make the blank.

However, all surrogate recoveries in the actual samples associated with the QC set were within the acceptance limits of 80-125%.

The DQO acceptance limits for analytes in both equipment blanks (n=4) and field blanks (n=8) were "less than the reporting limit" of 0.007 ppb diazinon and 0.004 ppb chlorpyrifos. No analytes were detected in any of the blanks. An equipment blank collected on 15 February in the Delta had a low (66%) surrogate recovery during analysis and was not re-analyzed due to a lab scheduling error.

**Sampling Schedule Notes**

A blank quality control sample scheduled for the Feather River site on the 13$^{th}$ day of sampling was instead collected on the 10$^{th}$ day because of the modified sampling schedule. A spike scheduled for the Colusa Basin Drain site on 25 February 2005 was instead mistakenly collected at the Sacramento River at Colusa site.

**A Comparison of Two Sampling Methods**

The California Department of Pesticide Regulation (DPR) conducted a separate pesticide monitoring study of winter storm runoff in the Sacramento Valley during the same period as this study. DPR collected 10 water samples from three common sites (the Feather River at Verona, the Sacramento River at Colusa and the Sacramento River at the Tower Bridge in Sacramento) on the same dates and at approximately the same times as the sampling efforts being conducted for this study. All samples were analyzed at the CDFA lab using the GCMS method described in this report.

The simultaneous collection and similar analysis allows a limited comparison of the detected concentrations of diazinon from two methods of sample collection: a grab sample taken (by DPR personnel) with a pole sampler from the riverbank and a velocity weighted composite sample taken (by UCD personnel) with a USGS D77 sampler, from a boat, at equal width increments (EWI) across the channel width. The first method is simple, less expensive and can be performed by one person. The second method is labor intensive and requires a boat and a three person sampling crew.

No diazinon was detected in any of the eight samples from the Sacramento River at Colusa (Table 5). Three of the four samples collected with the EWI method from the Sacramento River at the Tower Bridge had concentrations (0.007 – 0.008 ppb) of diazinon at or just above the limit of detection (0.007 ppb). The fourth EWI sample

showed no detection of diazinon. The four corresponding grab samples all had detections of diazinon ranging from 0.007 to 0.012 ppb. The EWI samples collected from the Feather River on 21 and 22 February had detections of 0.019 and 0.015 ppb, respectively. The corresponding grab samples had detections of 0.022 ppb and 0.016 ppb, respectively. Only the grab sample from the Feather River on 21 February had a detection of diazinon above the laboratory's 0.020 ppb limit of quantitation.

**Table 5.** Comparison of diazinon concentrations using two different collection methods at three sites in the Sacramento River Basin, California.

E, estimate; µg/L, microgram per liter; <, less than; EWI, Equal Width Increments. Analysis by Gas Chromatography/Mass Spectrometry (GC/MS)

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time)[1] | Diazinon concentration (µg/L) of samples collected with EWI method[2] | Diazinon concentration (µg/L) of samples collected with single grab from bank[2] |
|---|---|---|---|---|---|
| 2 | Sacramento River at Colusa | 11389500 | 2/17/05 12:20, 12:00<br>2/18/05 13:20, 13:20<br>2/19/05 11:40, 11:50<br>2/21/05 12:20, 12:15 | <0.007<br><0.007<br><0.007<br><0.007 | <0.007<br><0.007<br><0.007<br><0.007 |
| 3 | Feather River at Verona | 384752121375301 | 2/21/05 11:00, 11:10<br>2/22/05 11:10, 11:15 | E0.019<br>E 0.015 | 0.022<br>E 0.016 |
| 7 | Sacramento River at the Tower Bridge | 383430121302001 | 2/17/05 10:10, 10:15<br>2/18/05 9:50, 09:55<br>2/19/05 9:50, 10:00<br>2/21/05 10:00, 09:30 | E 0.007<br><0.007<br>E 0.008<br>E0.008 | E 0.008<br>E 0.012<br>E 0.007<br>E 0.008 |

[1] First sampling time is for EWI sample. Second sampling time is for grab sample
[2] Personnel from UC Davis collected composite samples using the EWI method, and a D77 sampler, from a boat. Personnel from California Department of Pesticide Regulation collected grab samples from the riverbank, at a single point, using a pole sampler.

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# Appendices

**Appendix 1a.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the Sacramento River Basin, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; E, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than]; B, biased low due to low surrogate recovery in sample; BL, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Colusa Basin Drain near Knight's Landing | 11390890 | 2/15/05 15:40 | IG | 955 | <0.004 | NA | E 0.010 | 23.36 |
| | | | 2/16/05 11:30 | IG | 1019 | <0.004 | NA | E 0.013 | 32.41 |
| | | | 2/17/05 14:00 | IG | 1140 | <0.004 | NA | E 0.010 | 27.89 |
| | | | 2/18/05 14:40 | IG | 1189 | <0.004 | NA | E 0.017 | 49.45 |
| | | | 2/19/05 13:10 | IG | 1444 | <0.004 | NA | E 0.017 | 60.06 |
| | | | 2/20/05 15:10 | IG | 2078 | <0.004 | NA | 0.034 | 172.85 |
| | | | 2/21/05 14:00 | IG | NA | <0.004 | NA | E 0.018 | NA |
| | | | 2/22/05 15:30 | IG | 2845 | <0.004 | NA | 0.026 | 180.97 |
| | | | 2/23/05 14:20 | IG | 2996 | <0.004 | NA | 0.020 | 146.59 |
| | | | 2/24/05 14:20 | IG | 3038 | <0.004 | NA | 0.021 | 156.08 |
| | | | 2/25/05 14:10 | IG | 2982 | <0.004 | NA | 0.022 | 160.50 |
| 2 | Sacramento River at Colusa | 11389500 | 2/15/05 18:30[1] | IG | 11700 | <0.004 | NA | <0.007 | NA |
| | | | 2/16/05 15:20 | IG | 10900 | <0.004 | NA | <0.007 | NA |
| | | | 2/17/05 12:20 | IG | 10200 | <0.004 | NA | <0.007 | NA |
| | | | 2/18/05 11:40 | IG | 10300 | <0.004 | NA | <0.007 | NA |
| | | | 2/19/05 13:20 | IG | 10200 | <0.004 | NA | <0.007 | NA |
| | | | 2/20/05 12:30 | IG | 11600 | <0.004 | NA | <0.007 | NA |
| | | | 2/21/05 12:20 | IG | 17600 | <0.004 | NA | <0.007 | NA |
| | | | 2/22/05 14:30 | IG | 16500 | <0.004 | NA | <0.007 | NA |
| | | | 2/23/05 12:10 | IG | 15800 | <0.004 | NA | <0.007 | NA |
| | | | 2/24/05 12:30 | IG | 17600 | <0.004 | NA | <0.007 | NA |
| | | | 2/25/05 12:00 | IG | 17400 | <0.004 | NA | <0.007 | NA |

[1] This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

**Appendix 1a.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the Sacramento River Basin, California – *Continued*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | Feather River at Verona | 384752121375301 | 2/16/05 12:00 | IG | 4096 | <0.004 | NA | E 0.015 | 150.31 |
| | | | 2/17/05 11:40 | IG | 3964 | <0.004 | NA | BL, E 0.015 | 145.47 |
| | | | 2/18/05 11:20 | IG | 4062 | <0.004 | NA | E 0.011 | 109.31 |
| | | | 2/19/05 12:30 | IG | 3463 | <0.004 | NA | E 0.014 | 118.61 |
| | | | 2/20/05 12:00 | IG | 4890 | <0.004 | NA | E 0.010 | 119.63 |
| | | | 2/21/05 11:00 | IG | 5017 | <0.004 | NA | E 0.019 | 233.21 |
| | | | 2/22/05 11:10 | IG | 6167 | <0.004 | NA | E 0.015 | 226.31 |
| | | | 2/23/05 11:10 | IG | 6062 | <0.004 | NA | <0.007 | NA |
| | | | 2/24/05 10:50 | IG | 5240 | <0.004 | NA | <0.007 | NA |
| | | | 2/25/05 10:40 | IG | 4697 | <0.004 | NA | <0.007 | NA |
| 4 | Sacramento Slough | 384649121381101 | 2/16/05 13:20 | IG | 771 | <0.004 | NA | 0.041 | 77.34 |
| | | | 2/17/05 13:30 | IG | 1003 | <0.004 | NA | BL 0.021 | 51.53 |
| | | | 2/18/05 12:50 | IG | 1126 | <0.004 | NA | 0.039 | 107.44 |
| | | | 2/19/05 14:10 | IG | 987 | <0.004 | NA | 0.031 | 74.86 |
| | | | 2/20/05 13:20 | IG | 926 | <0.004 | NA | 0.032 | 72.49 |
| | | | 2/21/05 12:30 | IG | 951 | <0.004 | NA | 0.034 | 79.11 |
| | | | 2/22/05 12:20 | IG | 1033 | <0.004 | NA | 0.027 | 68.24 |
| | | | 2/23/05 12:30 | IG | 1697 | <0.004 | NA | 0.029 | 120.40 |
| | | | 2/24/05 12:10 | IG | 1862 | E 0.004 | 18.22 | 0.025 | 113.88 |
| | | | 2/25/05 12:40 | IG | 1818 | <0.004 | NA | 0.017 | 75.61 |
| | | | 2/26/05 10:30 | IG | 2012 | <0.004 | NA | E 0.015 | 73.84 |
| 5 | Sacramento River at Veterans Br. | 384027121373401 | 2/16/05 14:20 | IG | 16200 | <0.004 | NA | E 0.007 | 277.43 |
| | | | 2/17/05 14:50 | IG | 16800 | <0.004 | NA | BL, E 0.007 | 287.71 |
| | | | 2/18/05 14:10 | IG | 16500 | <0.004 | NA | E 0.007 | 282.57 |
| | | | 2/19/05 15:40 | IG | 16400 | <0.004 | NA | E 0.009 | 361.10 |
| | | | 2/20/05 14:50 | IG | 17100 | <0.004 | NA | E 0.008 | 334.68 |
| | | | 2/21/05 14:00 | IG | 20800 | <0.004 | NA | E 0.011 | 559.76 |
| | | | 2/22/05 15:10 | IG | 26600 | <0.004 | NA | <0.007 | NA |
| | | | 2/23/05 13:40 | IG | 27300 | <0.004 | NA | E 0.007 | 467.53 |
| | | | 2/24/05 14:10 | IG | 26200 | <0.004 | NA | <0.007 | NA |
| | | | 2/25/05 14:00 | IG | 25900 | <0.004 | NA | <0.007 | NA |

**Appendix 1a.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the Sacramento River Basin, California – *Continued*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs)[2] | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Sacramento River at Tower Bridge | 383430121302001 | 2/15/05 13:50 | IG | 20530 | <0.004 | NA | E 0.007 | 351.59 |
| | | | 2/16/05 10:20 | IG | 16895 | <0.004 | NA | E 0.008 | 330.67 |
| | | | 2/17/05 10:10 | IG | 19798 | <0.004 | NA | E 0.007 | 339.05 |
| | | | 2/18/05 9:50 | IG | 20940 | <0.004 | NA | <0.007 | NA |
| | | | 2/19/05 9:50 | IG | 21350 | <0.004 | NA | E 0.008 | 417.86 |
| | | | 2/20/05 10:00 | IG | 22432 | <0.004 | NA | E 0.008 | 439.04 |
| | | | 2/21/05 10:00 | IG | 27455 | <0.004 | NA | E 0.008 | 537.35 |
| | | | 2/22/05 11:30 | IG | 32004 | <0.004 | NA | <0.007 | NA |
| | | | 2/23/05 10:10 | IG | 33330 | <0.004 | NA | <0.007 | NA |
| | | | 2/24/05 10:50 | IG | 30430 | <0.004 | NA | E 0.008 | 595.58 |
| | | | 2/25/05 9:40 | IG | 30184 | <0.004 | NA | <0.007 | NA |
| | | | 2/26/05 14:20 | IG | 30330 | <0.004 | NA | <0.007 | NA |

[2] Flows in gray shade were generated by building a relationship between the I Street gage near the Tower Bridge and the Freeport gage approximately 15 miles downstream. This was done because the I Street gage was below its rating table at the time the sample was collected. The relationship is $Y=0.8321 x + 5264.3$ with an $r^2$ value of 0.96.

**Appendix 1b.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the Sacramento/San Joaquin Delta, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; E, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than]; B, biased low due to low surrogate recovery in sample; BL, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Mosher Slough at Mariners Drive | Delta 02 | 2/15/05 12:30 | BG | NA | 0.011 | NA | 0.012 | NA |
| | | | 2/16/05 13:10 | BG | NA | 0.012 | NA | 0.012 | NA |
| | | | 2/17/05 16:40 | BG | NA | BL, E 0.008 | NA | BL 0.011 | NA |
| | | | 2/18/05 15:10 | BG | NA | 0.036 | NA | 0.086 | NA |
| | | | 2/19/05 15:40 | BG | NA | 0.016 | NA | 0.089 | NA |
| 2 | Five Mile Slough at Plymouth Road | Delta 03 | 2/15/05 12:50 | BG | NA | <0.004 | NA | 0.130 | NA |
| | | | 2/16/05 13:30 | BG | NA | 0.018 | NA | 0.110 | NA |
| | | | 2/17/05 16:30 | BG | NA | BL 0.012 | NA | BL 0.110 | NA |
| | | | 2/18/05 14:50 | BG | NA | 0.028 | NA | 0.110 | NA |
| | | | 2/19/05 15:30 | BG | NA | <0.004 | NA | 0.0970 | NA |
| 3 | Calaveras River at Ijams Road | Delta 04 | 2/15/05 13:20 | BG | 23.23 | <0.004 | NA | 0.096 | 5.46 |
| | | | 2/16/05 14:00 | BG | 146.21 | E 0.009 | 3.22 | 0.032 | 11.45 |
| | | | 2/17/05 14:00 | BG | 332.59 | BL, E 0.005 | 4.07 | <0.007 | NA |
| | | | 2/18/05 13:10 | BG | 140.28 | E 0.006 | 2.06 | E 0.008 | 2.75 |
| | | | 2/19/05 13.40 | BG | 262.96 | E 0.006 | 3.86 | E 0.007 | 4.50 |
| 4 | Mid-Roberts Island Drain | Delta 05 | 2/15/05 15:20[1] | BG | NA | <0.004 | NA | <0.007 | NA |
| | | | 2/16/05 17:00 | BG | NA | E 0.007 | NA | 0.030 | NA |
| | | | 2/17/05 12:50 | BG | NA | <0.004 | NA | BL 0.023 | NA |
| | | | 2/18/05 12:10 | BG | NA | E 0.005 | NA | E 0.015 | NA |
| | | | 2/19/05 12:40 | BG | NA | E 0.004 | NA | E 0.011 | NA |

[1] This sample had a low surrogate recovery 64% during analysis. The sample should have been re-extracted and re-analyzed. The laboratory, through scheduling problems, failed to re-extract the sample in a timely manner. Since the sample was already 30 days past the holding period it was not re-extracted.

**Appendix 1b.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the Sacramento River Basin, California – *Continued*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 5 | French Camp Slough at Airport Way | Delta 06 | 2/15/05 14:50 | BG | 40.90 | <0.004 | NA | 0.030 | 3.00 |
| | | | 2/16/05 16:30 | BG | 706.00 | E 0.007 | 12.09 | 0.047 | 81.18 |
| | | | 2/17/05 16:00 | BG | 1420.00 | BL, E 0.007 | 24.32 | BL, E 0.019 | 66.01 |
| | | | 2/18/05 12:40 | BG | 1779.00 | E 0.004 | 17.41 | E 0.018 | 78.34 |
| | | | 2/19/05 13:10 | BG | 854.00 | E 0.007 | 14.63 | 0.021 | 43.88 |
| 6 | Ulatis Creek at Brown Road | Delta 10 | 2/15/05 16:40 | BG | 168.26 | <0.004 | NA | <0.007 | NA |
| | | | 2/16/05 9:50 | BG | 1376.58 | 0.012 | 40.41 | 0.460 | 1549.19 |
| | | | 2/17/05 9:40 | BG | 316.70 | BL 0.034 | 26.34 | BL 0.180 | 139.47 |
| | | | 2/18/05 8:50 | BG | 249.54 | 0.032 | 19.54 | 0.070 | 42.73 |
| | | | 2/19/05 9:10 | BG | 354.76 | 0.027 | 23.43 | 0.085 | 73.77 |
| 7 | Duck Slough | Delta 11 | 2/15/05 11:30[2] | BG | NA | <0.004 | NA | <0.007 | NA |
| | | | 2/16/05 12:00 | BG | NA | <0.004 | NA | <0.007 | NA |
| | | | 2/17/05 11:50 | BG | NA | <0.004 | NA | BL, E 0.008 | NA |
| | | | 2/18/05 11:00 | BG | NA | E 0.005 | NA | E 0.008 | NA |
| | | | 2/19/05 11:10 | BG | NA | <0.004 | NA | <0.007 | NA |

[2] This sample was re-analyzed due to low surrogate recovery (71%). The re-analysis recovery rate (83%) was within the acceptance limits specified in the QAPP.

**Appendix 1c.** Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the San Joaquin River Basin, California.

Stream flow is in cubic feet per second. IG, integrated grab; BG, bank grab; E, estimate; NA, not available; grams a.i./d, grams active ingredient per day; µg/L, microgram per liter; <, less than]; B, biased low due to low surrogate recovery in sample; BL, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Stanislaus River at Caswell State Park | 374209121103800 | 1/27/2005 7:00 | BG | 296 | 0.022 | 15.93 | 0.190 | 137.59 |
| | | | 1/27/2005 11:50 | BG | 304 | 0.015 | 11.16 | 0.220 | 163.62 |
| | | | 1/28/2005 6:50 | BG | 464 | 0.015 | 17.03 | 0.300 | 340.55 |
| | | | 1/28/2005 11:20 | BG | 420 | 0.018 | 18.50 | 0.130 | 133.58 |
| | | | 1/29/2005 8:30 | BG | 825 | 0.018 | 36.33 | 0.17 | 343.12 |
| | | | 1/29/2005 13:00 | BG | 900 | 0.015 | 33.03 | 0.082 | 180.55 |
| | | | 1/30/2005 10:40 | BG | 566 | 0.009 | 12.46 | 0.088 | 121.86 |
| | | | 1/30/2005 15:30 | BG | 507 | E 0.007 | 8.68 | 0.098 | 121.56 |
| | | | 2/15/2005 6:40[3] | BG | 287 | <0.004 | NA | E 0.011 | 7.72 |
| | | | 2/15/2005 11:30[4] | BG | 300 | <0.004 | NA | E 0.011 | 8.07 |
| | | | 2/16/2005 7:40 | BG | 346 | E 0.005 | 4.23 | 0.038 | 32.17 |
| | | | 2/16/2005 12:10 | BG | 382 | E 0.008 | 7.48 | 0.030 | 28.04 |
| | | | 2/17/2005 6:30 | BG | 669 | E 0.005 | 8.18 | 0.052 | 85.11 |
| | | | 2/17/2005 11:00 | BG | 642 | E 0.006 | 9.42 | 0.084 | 131.93 |
| | | | 2/18/2005 6:50 | BG | 511 | <0.004 | NA | BL, E 0.019 | 23.75 |
| | | | 2/18/2005 11:20 | BG | 445 | BL, E 0.006 | 6.53 | BL 0.032 | 34.84 |
| 2 | San Joaquin River at Vernalis | 11303500 | 1/27/2005 7:40 | IG | 2850 | E 0.007 | 48.81 | 0.050 | 348.63 |
| | | | 1/27/2005 12:20 | IG | 2850 | 0.010 | 69.73 | 0.077 | 536.88 |
| | | | 1/28/2005 7:20 | IG | 2940 | E 0.007 | 50.35 | 0.054 | 388.41 |
| | | | 1/28/2005 11:50 | IG | 3240 | 0.010 | 79.27 | 0.040 | 317.07 |
| | | | 1/29/2005 9:00 | IG | 3810 | E 0.009 | 83.89 | 0.047 | 438.09 |
| | | | 1/29/2005 13:30 | IG | 4020 | E 0.009 | 88.51 | 0.056 | 550.76 |
| | | | 1/30/2005 11:10 | IG | 5720 | 0.013 | 181.92 | 0.047 | 657.72 |
| | | | 1/30/2005 16:10 | IG | 5640 | 0.011 | 151.78 | 0.045 | 620.92 |

[3] This sample had a surrogate recovery of 50%. The sample should have been re-extracted and re-analyzed. The laboratory through scheduling problems failed to re-extract the sample in a timely manner. The scheduling of sample re-extractions was changed to facilitate timely re-extractions. Since the sample was over 30 days past the holding time the sample was not re-extracted.

[4] This sample had a slightly low surrogate recovery of 77%. The sample was re-analyzed on 23 March. The surrogate recovery was 90% meeting the QAPP acceptance limits.

Appendix 1c. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the San Joaquin River Basin, California. *(continued)*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 2 | San Joaquin River at Vernalis *cont.* | 11303500 | 2/15/2005 7:20 | IG | 3390 | <0.004 | NA | <0.007 | NA |
| | | | 2/15/2005 12:10 | IG | 3420 | <0.004 | NA | <0.007 | NA |
| | | | 2/16/2005 8:20 | IG | 3890 | E 0.005 | 47.58 | E 0.013 | 123.72 |
| | | | 2/16/2005 12:50 | IG | 4120 | <0.004 | NA | E 0.012 | 120.95 |
| | | | 2/17/2005 7:10 | IG | 5040 | <0.004 | NA | E 0.014 | 172.63 |
| | | | 2/17/2005 11:30 | IG | 5300 | <0.004 | NA | E 0.011 | 142.63 |
| | | | 2/18/2005 7:30 | IG | 5900 | <0.004 | NA | BL, E 0.007 | 101.04 |
| | | | 2/18/2005 11:50 | IG | 5940 | BL, E 0.004 | 58.13 | <0.007 | NA |
| 3 | Tuolumne River at Shiloh Road | 11290200 | 1/27/2005 8:20 | IG | 285 | 0.025 | 17.43 | 0.570 | 397.43 |
| | | | 1/27/2005 13:00 | IG | 294 | 0.024 | 17.26 | 0.490 | 352.44 |
| | | | 1/28/2005 8:00 | IG | 1100 | 0.013 | 34.98 | 0.040 | 107.65 |
| | | | 1/28/2005 12:40 | IG | 867 | 0.013 | 27.57 | 0.040 | 84.84 |
| | | | 1/29/2005 9:20 | IG | 2410 | 0.013 | 76.65 | 0.130 | 766.49 |
| | | | 1/29/2005 14:00 | IG | 2960 | 0.012 | 86.90 | 0.044 | 318.63 |
| | | | 1/30/2005 11:50 | IG | 1170 | E 0.008 | 22.90 | 0.099 | 283.38 |
| | | | 1/30/2005 16:30 | IG | 938 | 0.010 | 22.95 | 0.16 | 367.17 |
| | | | 2/15/2005 8:00[5] | IG | 1780 | <0.004 | NA | E 0.014 | 60.97 |
| | | | 2/15/2005 12:50 | IG | 1900 | <0.004 | NA | <0.007 | NA |
| | | | 2/16/2005 9:00 | IG | 2100 | E 0.007 | 35.96 | E 0.018 | 92.48 |
| | | | 2/16/2005 13:20 | IG | 2120 | E 0.005 | 25.93 | E 0.013 | 67.43 |
| | | | 2/17/2005 7:40[6] | IG | 3060 | E 0.005 | 37.43 | E 0.010 | 74.86 |
| | | | 2/17/2005 12:10 | IG | 3130 | E 0.005 | 38.29 | <0.007 | NA |
| | | | 2/18/2005 8:00 | IG | 2930 | <0.004 | NA | <0.007 | NA |
| | | | 2/18/2005 12:20 | IG | 2900 | BL, E 0.005 | 35.47 | <0.007 | NA |

[5] This sample had a slightly low surrogate recovery of 76%. The sample was re-analyzed on 23 March. The surrogate recovery was 94% meeting the QAPP acceptance limits.

[6] This sample had a Simazine value above the highest standard used by the CDFA lab. The dilution was overlooked and the sample extract dried out. The value reported for Simazine is an estimated concentration.

Appendix 1c. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the San Joaquin River Basin, California. *(continued)*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Collection method | Stream flow (cfs) | Chlorpyrifos concentration (µg/L) | Chlorpyrifos instantaneous loading rate (grams a.i./d) | Diazinon concentration (µg/L) | Diazinon instantaneous loading rate (grams a.i./d) |
|---|---|---|---|---|---|---|---|---|---|
| 4 | Merced River at River Road | 11273500 | 1/27/2005 9:20[7] | IG | 309 | E 0.008 | 6.05 | E 0.014 | 10.58 |
| | | | 1/28/2005 8:50 | IG | 738 | 0.040 | 72.22 | 0.120 | 216.66 |
| | | | 1/29/2005 10:30 | IG | 915 | 0.027 | 60.44 | 0.043 | 96.26 |
| | | | 1/30/2005 13:00 | IG | 771 | 0.054 | 101.86 | 0.095 | 179.19 |
| | | | 2/15/2005 9:20 | IG | 276 | <0.004 | NA | <0.007 | NA |
| | | | 2/16/2005 10:20 | IG | 299 | <0.004 | NA | <0.007 | NA |
| | | | 2/17/2005 8:50 | IG | 738 | <0.004 | NA | <0.007 | NA |
| | | | 2/18/2005 9:20 | IG | 564 | BL 0.012 | 16.56 | BL, E 0.019 | 26.22 |
| 5 | San Joaquin River at Lander Avenue | 11260815 | 1/27/2005 9:50 | BG | 795 | E 0.007 | 13.61 | E 0.013 | 25.28 |
| | | | 1/28/2005 9:20 | BG | 1418 | 0.010 | 34.69 | 0.032 | 111.01 |
| | | | 1/29/2005 11:00 | BG | 1575 | 0.010 | 38.53 | 0.032 | 123.30 |
| | | | 1/30/2005 13:20 | BG | 1783 | E 0.008 | 34.90 | 0.018 | 78.52 |
| 6 | San Joaquin River at Patterson | 11274570 | 2/15/2005 8:40 | BG | 981 | <0.004 | NA | E 0.008 | 19.20 |
| | | | 2/16/2005 9:40 | BG | 1443 | <0.004 | NA | E 0.011 | 38.83 |
| | | | 2/17/2005 8:10 | BG | 1830 | 0.010 | 44.77 | <0.007 | NA |
| | | | 2/18/2005 8:40 | BG | 2195 | <0.004 | NA | BL, E 0.011 | 59.07 |

[7] This sample had a slightly low surrogate recovery of 74%. The sample was re-analyzed on 23 March. The surrogate recovery was 93% meeting the QAPP acceptance limits.

**Appendix 2.** Summary of diazinon concentrations for sites in the Sacramento River Basin, California analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) and by Enzyme-Linked Immunosorbent Assay (ELISA).

E, estimate; NA, not available; µg/L, microgram per liter; <, less than; BL, biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Diazinon concentration (µg/L), GC/MS | Diazinon concentration (µg/L), ELISA |
|---|---|---|---|---|---|
| 1 | Colusa Basin Drain near Knight's Landing | 11390890 | 2/15/05 15:40 | E 0.010 | 0.014 |
| | | | 2/16/05 11:30 | E 0.013 | 0.017 |
| | | | 2/17/05 14:00 | E 0.010 | 0.017 |
| | | | 2/18/05 14:40 | E 0.017 | 0.017 |
| | | | 2/19/05 13:10 | E 0.017 | 0.017 |
| | | | 2/20/05 15:10 | 0.034 | 0.040 |
| | | | 2/21/05 14:00 | E 0.018 | 0.028 |
| | | | 2/22/05 15:30 | 0.026 | 0.031 |
| | | | 2/23/05 14:20 | E 0.020 | 0.030 |
| | | | 2/24/05 14:20 | 0.021 | 0.034 |
| | | | 2/25/05 14:10 | 0.022 | NA |
| 2 | Sacramento River at Colusa | 11389500 | 2/15/05 18:30 | <0.007[8] | 0.012 |
| | | | 2/16/05 15:20 | <0.007 | 0.012 |
| | | | 2/17/05 12:20 | <0.007 | 0.015 |
| | | | 2/18/05 13:20 | <0.007 | 0.017 |
| | | | 2/19/05 11:40 | <0.007 | 0.008 |
| | | | 2/20/05 12:30 | <0.007 | 0.014 |
| | | | 2/21/05 12:20 | <0.007 | 0.023 |
| | | | 2/22/05 14:30 | <0.007 | 0.017 |
| | | | 2/23/05 12:10 | <0.007 | 0.021 |
| | | | 2/24/05 12:30 | <0.007 | 0.021 |
| | | | 2/25/05 12:00 | <0.007 | NA |
| 3 | Feather River at Verona | 384752121375301 | 2/16/05 12:00 | E 0.015 | 0.018 |
| | | | 2/17/05 11:40 | BL, E 0.015 | 0.024 |
| | | | 2/18/05 11:20 | E 0.011 | 0.023 |
| | | | 2/19/05 12:30 | E 0.014 | 0.012 |
| | | | 2/20/05 12:00 | E 0.010 | 0.022 |
| | | | 2/21/05 11:00 | E 0.019 | 0.029 |
| | | | 2/22/05 11:10 | E 0.015 | 0.027 |
| | | | 2/23/05 11:10 | <0.007 | 0.023 |
| | | | 2/24/05 10:50 | <0.007 | 0.025 |
| | | | 2/25/05 10:40 | <0.007 | NA |
| 5 | Sacramento Slough | 384649121381101 | 2/16/05 13:20 | 0.041 | 0.031 |
| | | | 2/17/05 13:30 | BL 0.021 | 0.039 |
| | | | 2/18/05 12:50 | 0.039 | 0.032 |
| | | | 2/19/05 14:10 | 0.031 | 0.020 |
| | | | 2/20/05 13:20 | 0.032 | 0.041 |
| | | | 2/21/05 12:30 | 0.034 | 0.039 |
| | | | 2/22/05 12:20 | 0.027 | 0.032 |
| | | | 2/23/05 12:30 | 0.029 | 0.037 |
| | | | 2/24/05 12:10 | 0.025 | 0.029 |
| | | | 2/25/05 12:40 | E 0.017 | NA |

[8] This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

**Appendix 2.** Summary of diazinon concentrations for sites in the Sacramento River Basin, California analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) and by Enzyme-Linked Immunosorbent Assay (ELISA) - *Continued*

| Site number | Site name | Site identification number | Date and time (month/day/year 24-hour time) | Diazinon concentration (µg/L), GC/MS | Diazinon concentration (µg/L), ELISA |
|---|---|---|---|---|---|
| 6 | Sacramento River at Veterans Br. | 384027121373401 | 2/16/05 14:20 | E 0.007 | 0.018 |
| | | | 2/17/05 14:50 | BL, E 0.007 | 0.014 |
| | | | 2/18/05 14:10 | E 0.007 | 0.010 |
| | | | 2/19/05 15:40 | E 0.009 | 0.011 |
| | | | 2/20/05 14:50 | E 0.008 | 0.021 |
| | | | 2/21/05 14:00 | E 0.011 | 0.021 |
| | | | 2/22/05 15:10 | <0.007 | 0.019 |
| | | | 2/23/05 13:40 | E 0.007 | 0.021 |
| | | | 2/24/05 14:10 | <0.007 | 0.023 |
| | | | 2/25/05 14:00 | <0.007 | NA |
| 7 | Sacramento River at Tower Bridge | 383430121302001 | 2/15/05 13:50 | E 0.007 | 0.016 |
| | | | 2/16/05 10:20 | E 0.008 | 0.018 |
| | | | 2/17/05 10:10 | E 0.007 | 0.016 |
| | | | 2/18/05 9:50 | <0.007 | 0.011 |
| | | | 2/19/05 9:50 | E 0.008 | 0.012 |
| | | | 2/20/05 10:00 | E 0.008 | 0.021 |
| | | | 2/21/05 10:00 | E 0.008 | 0.015 |
| | | | 2/22/05 11:30 | <0.007 | 0.024 |
| | | | 2/23/05 10:10 | <0.007 | 0.024 |
| | | | 2/24/05 10:50 | E 0.008 | 0.022 |
| | | | 2/25/05 9:40 | <0.007 | NA |
| | | | 2/26/05 14:20 | <0.007 | NA |

**Appendix 3a.** Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento River Basin, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; E: estimate; <: less than; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site identification number | Site name | Date and time (month/day/year 24-hour time) | Chlorpyrifos (ug/L) | Relative percent difference OR percent recovery (chlorpyrifos)* | Diazinon (ug/L) | Relative percent difference OR percent recovery (diazinon)* |
|---|---|---|---|---|---|---|
| DUPLICATES | | | | | | |
| 384649121381101 | Sacramento Slough | 2/17/05 13:30 | <0.004 | | BL 0.021 | |
| | | 2/17/05 13:33[1] | <0.004 | NA | 0.025 | 17.39% |
| 383430121302001 | Sacramento River at Tower Bridge | 2/16/05 10:20 | <0.004 | | E 0.008 | |
| | | 2/16/05 10:23[2] | <0.004 | NA | E 0.009 | 11.76% |
| 384752121375301 | Feather River near Verona | 2/20/05 12:00 | <0.004 | | E 0.010 | |
| | | 2/20/05 12:03[2] | <0.004 | NA | E 0.011 | 9.52% |
| 11389500 | Sacramento River at Colusa | 2/23/05 12:10 | <0.004 | | <0.007 | |
| | | 2/23/05 12:16[1,3] | <0.004 | NA | <0.007 | NA |
| BLANKS | | | | | | |
| 11390890 | Colusa Basin Drain near Knights Landing | 2/15/05 15:41[4] | <0.004 | | <0.007 | |
| 383430121302001 | Sacramento River at Tower Bridge | 2/15/05 13:51[4,7] | <0.004 | | <0.007 | |
| 384027121373401 | Sacramento River at Veterans Bridge | 2/16/05 10:00 [3,4] | <0.004 | | <0.007 | |
| 11390890 | Colusa Basin Drain near Knights Landing | 2/17/05 14:01 | <0.004 | | <0.007 | |
| 384752121375301 | Feather River near Verona | 2/25/05 10:41 | <0.004 | | <0.007 | |
| 383430121302001 | Sacramento River at Tower Bridge | 2/24/05 10:51 | <0.004 | | <0.007 | |
| 384649121381101 | Sacramento Slough | 2/21/05 12:31 | <0.004 | | <0.007 | |
| SPIKES , SPIKE DUPLICATES[5,6] | | | | | | |
| 11389500 | Sacramento River at Colusa | 2/15/05 18:30 | <0.004 | | <0.007 | |
| | | 2/15/05 18:39 | | 94% | | 107% |
| | | 2/15/05 18:39 | | 94% | | 107% |
| | | | | ***0%*** | | ***0%*** |
| 11389500 | Sacramento River at Colusa | 2/25/05 12:00 | <0.004 | | <0.007 | |
| | | 2/25/05 12:09 | | 90% | | 93% |
| | | 2/25/05 12:09 | | 88% | | 103% |
| | | | | ***2%*** | | ***10%*** |
| 384027121373401 | Sacramento River at Veterans Bridge | 2/19/05 15:40 | <0.004 | | E 0.009 | |
| | | 2/19/05 15:49 | | 89% | | 106% |
| | | 2/19/05 15:49 | | 80% | | 82% |
| | | | | ***11%*** | | ***26%*** |
| 384752121375301 | Feather River near Verona | 2/19/05 12:30 | <0.004 | | E 0.014 | |
| | | 2/19/05 12:39 | | 82% | | 88% |
| | | 2/19/05 12:39 | | 97% | | 104% |
| | | | | ***17%*** | | ***17%*** |

[1] Sequential Duplicate
[2] Split Duplicate
[3] Sample time offset incorrect
[4] Equipment Blank
[5] Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon
[6] First line is environmental sample, second is matrix spike, third is matrix spike duplicate
[7] Sample was re-analyzed due to a low surrogate recovery (75%). The re-analysis recovery rate (92%) was within the QAPP acceptance limits.
*Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

**Appendix 3b.** Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the Sacramento/San Joaquin Delta, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; E: estimate; <: less than; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site identification number | Site name | Date and time (month/day/year 24-hour time) | Chlorpyrifos (ug/L) | Relative percent difference OR percent recovery (chlorpyrifos)* | Diazinon (ug/L) | Relative percent difference OR percent recovery (diazinon)* |
|---|---|---|---|---|---|---|
| DUPLICATES | | | | | | |
| Delta 02 | Mosher Slough at Mariners Drive | 2/15/05 12:30 | 0.011 | | 0.120 | |
| | | 2/15/05 12:35[1] | 0.011 | 0.00% | 0.130 | 8% |
| Delta 11 | Duck Slough | 2/16/05 12:00 | <0.004 | | <0.007 | |
| | | 2/16/05 12:05[1] | <0.004 | NA | <0.007 | NA |
| Delta 04 | Calaveras River at Ijams Road | 2/17/05 14:00 | BL, E 0.005 | | <0.007 | |
| | | 2/17/05 14:00[2] | BL, E 0.006 | 18.18% | <0.007 | NA |
| | | 2/17/05 14:00[2] | BL, E 0.008 | 46.15% | <0.007 | NA |
| Delta 05 | Mid-Roberts Island Drain | 2/18/05 12:10[1] | E 0.005 | | E 0.015 | |
| | | 2/18/05 12:15 | E 0.005 | 0.00% | E 0.012 | 22.22% |
| BLANKS | | | | | | |
| | Equipment Blank | 2/15/05 18:30[3] | <0.004 | | <0.007 | |
| Delta 03 | Five Mile Slough at Plymouth Road | 2/16/05 13:35 | <0.004 | | <0.007 | |
| Delta 06 | French Camp Slough at Airport Way | 2/19/05 13:15[4] | <0.004 | | <0.007 | |
| SPIKES[5,6] | | | | | | |
| Delta 10 | Ulatis Creek at Brown Road | 2/15/05 16:40 | <0.004 | | <0.007 | |
| | | 2/15/05 16:40 | | 81% | | 83% |
| | | 2/15/05 16:40 | | 82% | | 87% |
| | | | | ***1%*** | | ***5%*** |

[1]Split Duplicate

[2]These samples should have been analyzed as matrix spikes. The lab failed to add the matrix spike standard prior to extraction. They can be viewed as duplicates

[3]Surrogate recovery (66%) was outside of QAPP acceptance limits of 80-125%. Sample not re-analyzed due to lab scheduling error.

[4]Surrogate recovery (74%) was outside of QAPP acceptance limits of 80-125%. The sample was diluted by mistake and reanalyzed. The undiluted sample was reanalyzed on 4/6/2005. This reanalysis also had low surrogate recovery ( 62%). The sample was not re-extracted due to laboratory error. This error was not noted until over 4 weeks past the time of sample collection.

[5]Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon

[6] First sample in each pair is the environmental sample, second is matrix spike, third is matrix spike duplicate

*Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

**Appendix 3c.** Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the San Joaquin River Basin, California.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; E: estimate; <: less than; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details).

| Site identification number | Site name | Date and time (month/day/year 24-hour time) | Chlorpyrifos (ug/L) | Relative percent difference OR percent recovery (chlorpyrifos)* | Diazinon (ug/L) | Relative percent difference OR percent recovery (diazinon)* |
|---|---|---|---|---|---|---|
| DUPLICATES | | | | | | |
| 374209121103800 | Stanislaus River at Caswell State Park | 1/28/2005 11:20 | 0.018 | | 0.130 | |
| | | 1/28/2005 11:23[1] | 0.017 | 5.71% | 0.140 | 7.41% |
| 1126110 | San Joaquin River at Lander Avenue | 1/27/2005 9:50 | E 0.007 | | E 0.013 | |
| | | 1/27/2005 9:53[1] | E 0.007 | 0.00% | E 0.012 | 8.00% |
| 11303500 | San Joaquin River at Vernalis | 2/15/2005 12:10 | <0.004 | | <0.007 | |
| | | 2/15/2005 12:13[1] | <0.004 | NA | <0.007 | NA |
| 11273500 | Merced River at River Road | 2/18/2005 9:20 | BL 0.012 | | BL, E 0.019 | |
| | | 2/18/2005 9:23[1] | BL 0.012 | 0.00% | BL 0.020 | 5.13% |
| BLANKS | | | | | | |
| 11290200 | Tuolumne River at Shiloh Road | 1/29/2005 9:21 | <0.004 | | <0.007 | |
| 374209121103800 | Stanislaus River at Caswell State Park | 2/16/2005 7:41 | <0.004 | | <0.007 | |
| SPIKES , SPIKE DUPLICATES[2, 3] | | | | | | |
| 11303500 | San Joaquin River at Vernalis | 1/27/2005 7:40 | E 0.007 | | 0.050 | |
| | | 1/27/2005 7:49 | | 94% | | 121% |
| 11273500 | Merced River at River Road | 1/30/2005 13:00 | 0.054 | | 0.095 | |
| | | 1/30/2005 13:09 | | 84% | | 88% |
| 11290200 | Tuolumne River at Shiloh Road | 2/17/2005 12:10 | E 0.005 | | <0.007 | |
| | | 2/17/2005 12:19 | | 77% | | 114% |
| | | 2/17/2005 12:19 | | 89% | | 118% |
| | | | | ***14%*** | | ***3%*** |
| 11274570 | San Joaquin River at Patterson | 2/18/2005 8:40 | <0.004 | | BL, E 0.011 | |
| | | 2/18/2005 8:49 | | 95% | | 95% |
| | | 2/18/2005 8:49 | | 98% | | 100% |
| | | | | ***3%*** | | ***5%*** |

[1] Split Duplicate
[2] Spiked samples were injected with 0.05 ug/L of chlorpyrifos; 0.10 ug/L of diazinon
[3] First sample in each pair is the environmental sample, second is matrix spike, third is matrix spike duplicate
* Relative percent difference between matrix spike (MS) and matrix spike duplicate (MSD) is listed in bold italics below MS & MSD recoveries

**Appendix 4a. Sacramento pesticide results (excluding diazinon and chlorpyrifos).**
(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; B: biased low due to low surrogate recovery in sample; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for proparigate, bifenthrin and azinphos methyl which were not present at detectable levels).

| Site | Date | Time | EPTC (Eptam) | Simazine | Carbaryl | Metolachlor | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|
| Colusa Basin Drain at Knights Landing | 15-Feb-05 | 15:40 | ND | (0.032 J) | ND | (0.007 J) | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 16-Feb-05 | 11:30 | ND | (0.035 J) | ND | ND | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 17-Feb-05 | 14:00 | ND | 0.31 | ND | (0.017 J) | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 18-Feb-05 | 14:40 | ND | (0.076 J) | ND | 0.028 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 19-Feb-05 | 13:10 | ND | (0.12 J) | ND | 0.036 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 20-Feb-05 | 15:10 | ND | (0.20 J) | ND | 0.053 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 21-Feb-05 | 14:00 | ND | 0.28 | ND | 0.026 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 22-Feb-05 | 15:30 | ND | 0.47 | ND | 0.031 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 23-Feb-05 | 14:20 | ND | 0.32 | ND | 0.021 | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 24-Feb-05 | 14:20 | ND | 0.44 | ND | (0.017 J) | ND | ND | ND |
| Colusa Basin Drain at Knights Landing | 25-Feb-05 | 14:10 | ND | 0.27 | ND | (0.017 J) | ND | ND | ND |
| Sacramento River at Colusa[1] | 15-Feb-05 | 18:30 | ND | B (0.006 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 16-Feb-05 | 15:20 | ND | (0.009 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 17-Feb-05 | 12:20 | ND | ND | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 18-Feb-05 | 13:20 | ND | ND | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 19-Feb-05 | 11:40 | ND | (0.005 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 20-Feb-05 | 12:30 | ND | (0.035 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 21-Feb-05 | 12:20 | ND | (0.021 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 22-Feb-05 | 14:30 | ND | (0.019 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 23-Feb-05 | 12:10 | ND | (0.006 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 24-Feb-05 | 12:30 | ND | (0.005 J) | ND | ND | ND | ND | ND |
| Sacramento River at Colusa | 25-Feb-05 | 12:00 | ND | (0.006 J) | ND | ND | ND | ND | ND |
| Feather River near Verona | 16-Feb-05 | 12:00 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 17-Feb-05 | 11:40 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 18-Feb-05 | 11:20 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 19-Feb-05 | 12:30 | ND | ND | ND | ND | ND | ND | ND |

[1] This sample had low surrogate recovery (75%) during analysis. Due to a back up of samples waiting to be analyzed the low recovery was not noticed until over a month past the holding period. Therefore the sample was not re-extracted and re-analyzed. The results of the analysis should be viewed as biased low.

Appendix 4a *(Continued)*

| Site | Date | Time | EPTC (Eptam) | Simazine | Carbaryl | Metolachlor | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|
| Feather River near Verona | 20-Feb-05 | 12:00 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 21-Feb-05 | 11:00 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 22-Feb-05 | 11:10 | ND | (0.006 J) | ND | ND | ND | ND | ND |
| Feather River near Verona | 23-Feb-05 | 11:10 | ND | ND | ND | ND | ND | ND | ND |
| Feather River near Verona | 24-Feb-05 | 10:50 | ND | (0.011 J) | ND | ND | ND | ND | ND |
| Feather River near Verona | 25-Feb-05 | 10:40 | ND | (0.007 J) | ND | ND | ND | ND | ND |
| Sacramento Slough | 16-Feb-05 | 13:20 | ND | (0.014 J) | ND | ND | ND | ND | ND |
| Sacramento Slough | 17-Feb-05 | 13:30 | ND | BL (0.008 J) | ND | ND | ND | ND | ND |
| Sacramento Slough | 18-Feb-05 | 12:50 | ND | (0.010 J) | ND | (0.010 J) | ND | ND | ND |
| Sacramento Slough | 19-Feb-05 | 14:10 | ND | (0.012 J) | ND | (0.007 J) | ND | ND | ND |
| Sacramento Slough | 20-Feb-05 | 13:20 | ND | (0.023 J) | ND | (0.013 J) | ND | ND | ND |
| Sacramento Slough | 21-Feb-05 | 12:30 | ND | (0.022 J) | ND | 0.021 | ND | ND | ND |
| Sacramento Slough | 22-Feb-05 | 12:20 | ND | (0.024 J) | ND | (0.010 J) | ND | ND | ND |
| Sacramento Slough | 23-Feb-05 | 12:30 | ND | (0.047 J) | ND | (0.010 J) | ND | ND | ND |
| Sacramento Slough | 24-Feb-05 | 12:10 | ND | (0.046 J) | ND | (0.012 J) | ND | ND | ND |
| Sacramento Slough | 25-Feb-05 | 12:40 | ND | (0.038 J) | ND | (0.017 J) | ND | ND | ND |
| Sacramento Slough | 26-Feb-05 | 10:30 | ND | (0.037 J) | ND | (0.013 J) | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 16-Feb-05 | 14:20 | ND | (0.010 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 17-Feb-05 | 14:50 | ND | BL (0.013 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 18-Feb-05 | 14:10 | ND | (0.022 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 19-Feb-05 | 15:40 | ND | (0.013 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 20-Feb-05 | 14:50 | ND | (0.021 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 21-Feb-05 | 14:00 | ND | (0.036 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 22-Feb-05 | 15:10 | ND | (0.021 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 23-Feb-05 | 13:40 | ND | (0.039 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 24-Feb-05 | 14:10 | ND | (0.037 J) | ND | ND | ND | ND | ND |
| Sacramento River at Veteran's Bridge | 25-Feb-05 | 14:00 | ND | (0.026 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 15-Feb-05 | 13:50 | ND | (0.009 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 16-Feb-05 | 10:20 | ND | (0.035 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 17-Feb-05 | 10:10 | ND | (0.043 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 18-Feb-05 | 09:50 | ND | (0.018 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 19-Feb-05 | 09:50 | ND | (0.040 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 20-Feb-05 | 10:00 | ND | (0.075 J) | ND | ND | ND | ND | ND |

Appendix 4a *(Continued)*

| Site | Date | Time | EPTC (Eptam) | Simazine | Carbaryl | Metolachlor | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|
| Sacramento River at Tower Bridge | 21-Feb-05 | 10:00 | ND | (0.053 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 22-Feb-05 | 11:30 | ND | (0.021 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 23-Feb-05 | 10:10 | ND | (0.038 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 24-Feb-05 | 10:50 | ND | (0.032 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 25-Feb-05 | 09:40 | ND | (0.035 J) | ND | ND | ND | ND | ND |
| Sacramento River at Tower Bridge | 26-Feb-05 | 14:20 | ND | 0.020 | ND | ND | ND | ND | ND |

**Appendix 4b. Delta pesticide results (excluding diazinon and chlorpyrifos).**

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; B: biased low due to low surrogate recovery in sample; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for proparigate, bifenthrin and azinphos methyl which were not present at detectable levels).

| Site | Date | Time | EPTC (Eptam) | Simazine | Carbaryl | Metolachlor | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|
| Calaveras River at Ijams Rd | 15-Feb-05 | 13:20 | ND | 0.270 | ND | (0.018 J) | ND | ND | ND |
| Calaveras River at Ijams Rd | 16-Feb-05 | 14:00 | ND | 0.520 | ND | ND | ND | ND | (0.017 J) |
| Calaveras River at Ijams Rd | 17-Feb-05 | 14:00 | ND | BL 1.700 | ND | ND | ND | ND | ND |
| Calaveras River at Ijams Rd | 18-Feb-05 | 13:10 | ND | 1.300 | ND | ND | ND | ND | ND |
| Calaveras River at Ijams Rd | 19-Feb-05 | 13:40 | ND | 0.970 | ND | ND | ND | ND | ND |
| Duck Slough[9] | 15-Feb-05 | 11:30 | ND | 0.290 | ND | ND | ND | ND | ND |
| Duck Slough | 16-Feb-05 | 12:00 | ND | 0.240 | ND | ND | ND | ND | ND |
| Duck Slough | 17-Feb-05 | 11:50 | ND | BL 0.240 | ND | ND | BL (0.016 J) | ND | ND |
| Duck Slough | 18-Feb-05 | 11:00 | ND | 0.440 | ND | ND | ND | ND | ND |
| Duck Slough | 19-Feb-05 | 11:10 | ND | (0.010 J) | ND | (0.017 J) | ND | ND | ND |
| Five-mile Slough at Plymouth Rd | 15-Feb-05 | 12:50 | ND | 0.240 | ND | (0.011 J) | ND | ND | ND |
| Five-mile Slough at Plymouth Rd | 16-Feb-05 | 13:30 | ND | (0.066 J) | ND | ND | ND | ND | ND |
| Five-mile Slough at Plymouth Rd | 17-Feb-05 | 16:30 | ND | BL (0.11 J) | BL 0.048 | ND | ND | ND | ND |
| Five-mile Slough at Plymouth Rd | 18-Feb-05 | 14:50 | ND | (0.050 J) | 0.038 | ND | ND | ND | ND |
| Five-mile Slough at Plymouth Rd | 19-Feb-05 | 15:30 | ND | 0.240 | 0.030 | ND | ND | ND | ND |
| French Camp Slough at Airport Way | 15-Feb-05 | 14:50 | ND | 0.530 | ND | ND | ND | ND | ND |
| French Camp Slough at Airport Way | 16-Feb-05 | 16:30 | ND | 1.700 | ND | (0.015 J) | ND | ND | 0.058 |
| French Camp Slough at Airport Way | 17-Feb-05 | 16:00 | ND | BL 0.700 | ND | BL (0.014 J) | ND | ND | ND |
| French Camp Slough at Airport Way | 18-Feb-05 | 12:40 | ND | 0.570 | ND | ND | ND | ND | ND |
| French Camp Slough at Airport Way | 19-Feb-05 | 13:10 | ND | 0.860 | ND | ND | ND | ND | ND |
| Mid Roberts Island Drain[10] | 15-Feb-05 | 15:20 | ND | B 0.270 | ND | B 0.054 | ND | ND | ND |
| Mid Roberts Island Drain | 16-Feb-05 | 17:00 | ND | 0.810 | ND | 0.250 | ND | ND | ND |
| Mid Roberts Island Drain | 17-Feb-05 | 12:50 | ND | BL 1.700 | ND | BL 0.330 | ND | ND | ND |
| Mid Roberts Island Drain | 18-Feb-05 | 12:10 | ND | 1.900 | ND | 0.470 | ND | ND | ND |

9 This sample was re-analyzed due to low surrogate recovery (71%). The re-analysis recovery rate (83%) was within the acceptance limits specified in the QAPP.

10 This sample had a low surrogate recovery 64% during analysis. The sample should have been re-extracted and re-analyzed. The laboratory, through scheduling problems, failed to re-extract the sample in a timely manner. Since the sample was already 30 days past the holding period it was not re-extracted.

Appendix 4b. *(Continued)*

| Site | Date | Time | EPTC (Eptam) | Simazine | Carbaryl | Metolachlor | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|
| Mid Roberts Island Drain | 19-Feb-05 | 12:40 | ND | 1.200 | ND | 0.190 | ND | ND | ND |
| Mosher Slough at Mariner's Dr | 15-Feb-05 | 12:30 | ND | (0.180 J) | 0.100 | (0.012 J) | ND | ND | ND |
| Mosher Slough at Mariner's Dr | 16-Feb-05 | 13:10 | ND | (0.079 J) | 0.073 | ND | ND | ND | ND |
| Mosher Slough at Mariner's Dr | 17-Feb-05 | 16:40 | ND | BL (0.071 J) | BL 0.033 | BL 0.021 | ND | ND | BL (0.018 J) |
| Mosher Slough at Mariner's Dr | 18-Feb-05 | 15:10 | ND | (0.074 J) | 0.045 | (0.010 J) | ND | ND | ND |
| Mosher Slough at Mariner's Dr | 19-Feb-05 | 15:40 | ND | (0.140 J) | 0.047 | (0.007 J) | ND | ND | ND |
| Ulatis Creek at Brown Rd | 15-Feb-05 | 16:40 | ND | (0.073 J) | ND | ND | ND | ND | ND |
| Ulatis Creek at Brown Rd | 16-Feb-05 | 9:50 | ND | 4.400 | 0.023 | 0.026 | ND | ND | ND |
| Ulatis Creek at Brown Rd | 17-Feb-05 | 9:40 | ND | BL 3.200 | ND | BL 0.023 | ND | ND | ND |
| Ulatis Creek at Brown Rd | 18-Feb-05 | 8:50 | ND | 1.600 | ND | (0.016 J) | ND | ND | ND |
| Ulatis Creek at Brown Rd | 19-Feb-05 | 9:10 | ND | 1.500 | ND | 0.030 | ND | ND | ND |

**Appendix 4c. San Joaquin pesticide results (excluding diazinon and chlorpyrifos).**
(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; E: estimate; B: biased low due to low surrogate recovery in sample; BL: biased low due to low surrogate recovery in associated lab blank or lab spike (see Appendices 5 & 6 for details). Each sample was also analyzed for proparigate and azinphos methyl which were not present at detectable levels).

| Site | Date | Time | Eptam (EPTC) | Simazine | Carbaryl | Metolachlor | Bifenthrin | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|---|
| Stanislaus River at Caswell State Park | 27-Jan-05 | 07:00 | ND | 0.860 | ND | ND | ND | ND | (0.009 J) | 0.031 |
| Stanislaus River at Caswell State Park | 27-Jan-05 | 11:50 | ND | 0.520 | ND | ND | ND | ND | ND | (0.018 J) |
| Stanislaus River at Caswell State Park | 28-Jan-05 | 06:50 | ND | 0.390 | 0.100 | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 28-Jan-05 | 11:20 | ND | 0.480 | 0.058 | ND | ND | ND | ND | (0.010 J) |
| Stanislaus River at Caswell State Park | 29-Jan-05 | 08:30 | ND | 0.370 | (0.016 J) | ND | ND | ND | ND | (0.010 J) |
| Stanislaus River at Caswell State Park | 29-Jan-05 | 13:00 | ND | 0.460 | (0.011 J) | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 30-Jan-05 | 10:40 | ND | 0.250 | ND | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 30-Jan-05 | 15:30 | ND | 0.330 | ND | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park[11] | 15-Feb-05 | 06:40 | ND | B (0.14 J) | ND | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park[12] | 15-Feb-05 | 11:30 | ND | 0.230 | ND | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 16-Feb-05 | 07:40 | ND | 0.320 | (0.007 J) | (0.009 J) | ND | ND | (0.011 J) | ND |
| Stanislaus River at Caswell State Park | 16-Feb-05 | 12:10 | ND | 0.310 | (0.014 J) | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 17-Feb-05 | 06:30 | ND | 0.260 | ND | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 17-Feb-05 | 11:00 | ND | 0.350 | 0.022 | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 18-Feb-05 | 06:50 | ND | BL 0.320 | BL (0.019 J) | ND | ND | ND | ND | ND |
| Stanislaus River at Caswell State Park | 18-Feb-05 | 11:20 | ND | BL 0.360 | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 27-Jan-05 | 07:40 | ND | (0.11 J) | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 27-Jan-05 | 12:20 | ND | 0.220 | ND | ND | ND | ND | ND | (0.013 J) |
| San Joaquin River at Vernalis | 28-Jan-05 | 07:20 | ND | (0.11 J) | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 28-Jan-05 | 11:50 | ND | (0.11 J) | 0.033 | ND | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 29-Jan-05 | 09:00 | ND | 0.150 | ND | ND | ND | ND | ND | BLQ (0.016J) |
| San Joaquin River at Vernalis | 29-Jan-05 | 13:30 | ND | 0.160 | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 30-Jan-05 | 11:10 | ND | 0.600 | ND | ND | 0.030 | ND | ND | ND |
| San Joaquin River at Vernalis | 30-Jan-05 | 16:10 | ND | 0.620 | ND | ND | ND | ND | ND | ND |

[11] This sample had a surrogate recovery of 50%. The sample should have been re-extracted and re-analyzed. The laboratory through scheduling problems failed to re-extract the sample in a timely manner. The scheduling of sample re-extractions was changed to facilitate timely re-extractions. Since the sample was over 30 days past the holding time the sample was not re-extracted.

[12] This sample had a slightly low surrogate recovery of 77%. The sample was re-analyzed on 23 March. The surrogate recovery was 90% meeting the QAPP acceptance limits.

Appendix 4c. *(Continued)*

| Site | Date | Time | Eptam (EPTC) | Simazine | Carbaryl | Metolachlor | Bifenthrin | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|---|
| San Joaquin River at Vernalis | 15-Feb-05 | 07:20 | ND | (0.074 J) | ND | (0.009 J) | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 15-Feb-05 | 12:10 | ND | (0.062 J) | ND | (0.010 J) | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 16-Feb-05 | 08:20 | ND | (0.075 J) | ND | (0.014 J) | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 16-Feb-05 | 12:50 | ND | (0.098 J) | ND | 0.021 | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 17-Feb-05 | 07:10 | ND | 0.320 | ND | 0.030 | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 17-Feb-05 | 11:30 | ND | (0.150 J) | ND | (0.016 J) | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 18-Feb-05 | 07:30 | ND | BL 0.420 | ND | BL (0.012 J) | ND | ND | ND | ND |
| San Joaquin River at Vernalis | 18-Feb-05 | 11:50 | ND | BL 0.030 | ND | BL (0.011 J) | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 27-Jan-05 | 08:20 | ND | (0.120 J) | (0.016 J) | ND | ND | ND | ND | 0.068 |
| Tuolumne River at Shilo Road | 27-Jan-05 | 13:00 | ND | (0.100 J) | 0.027 | ND | ND | ND | ND | (0.030 J) |
| Tuolumne River at Shilo Road | 28-Jan-05 | 08:00 | ND | (0.140 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 28-Jan-05 | 12:40 | ND | (0.150 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 29-Jan-05 | 09:20 | ND | 0.830 | ND | (0.014 J) | (0.013 J) | ND | ND | 0.037 |
| Tuolumne River at Shilo Road | 29-Jan-05 | 14:00 | ND | 0.650 | ND | ND | ND | ND | ND | (0.022 J) |
| Tuolumne River at Shilo Road | 30-Jan-05 | 11:50 | ND | 1.200 | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 30-Jan-05 | 16:30 | ND | 1.100 | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road[13] | 15-Feb-05 | 08:00 | ND | (0.050 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 15-Feb-05 | 12:50 | ND | (0.036 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 16-Feb-05 | 09:00 | ND | (0.044 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 16-Feb-05 | 13:20 | ND | (0.100 J) | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road[14] | 17-Feb-05 | 07:40 | ND | E 1.800 | ND | ND | ND | (0.008 J) | ND | (0.021 J) |
| Tuolumne River at Shilo Road | 17-Feb-05 | 12:10 | ND | 1.100 | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 18-Feb-05 | 08:00 | ND | BL 0.210 | ND | ND | ND | ND | ND | ND |
| Tuolumne River at Shilo Road | 18-Feb-05 | 12:20 | ND | BL (0.160 J) | ND | ND | ND | ND | ND | ND |
| Merced River at River Road[15] | 27-Jan-05 | 09:20 | ND | (0.031 J) | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 28-Jan-05 | 08:50 | ND | 1.800 | ND | ND | ND | ND | ND | ND |

13 This sample had a slightly low surrogate recovery of 76%. The sample was re-analyzed on 23 March. The surrogate recovery was 94% meeting the QAPP acceptance limits.

14 This sample had a Simazine value above the highest standard used by the CDFA lab. The dilution was overlooked and the sample extract dried out. The value reported for Simazine is an estimated concentration.

15 This sample had a slightly low surrogate recovery of 74%. The sample was re-analyzed on 23 March. The surrogate recovery was 93% meeting the QAPP acceptance limits.

Appendix 4c. *(Continued)*

| Site | Date | Time | Eptam (EPTC) | Simazine | Carbaryl | Metolachlor | Bifenthrin | Cyan-azine | Dacthal (DCPA) | Methid-athion |
|---|---|---|---|---|---|---|---|---|---|---|
| Merced River at River Road | 29-Jan-05 | 10:30 | ND | 0.690 | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 30-Jan-05 | 13:00 | ND | 1.700 | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 15-Feb-05 | 09:20 | ND | (0.019 J) | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 16-Feb-05 | 10:20 | ND | (0.016 J) | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 17-Feb-05 | 08:50 | ND | (0.024 J) | ND | ND | ND | ND | ND | ND |
| Merced River at River Road | 18-Feb-05 | 09:20 | ND | BL 0.510 | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Lander Avenue | 27-Jan-05 | 09:50 | ND | (0.063 J) | ND | (0.008 J) | (0.007 J) | ND | ND | ND |
| San Joaquin River at Lander Avenue | 28-Jan-05 | 09:20 | ND | (0.110 J) | (0.014 J) | ND | ND | ND | ND | ND |
| San Joaquin River at Lander Avenue | 29-Jan-05 | 11:00 | ND | 0.110 | BLQ (0.007) | ND | ND | ND | ND | ND |
| San Joaquin River at Lander Avenue | 30-Jan-05 | 13:20 | ND | 0.160 | ND | ND | ND | ND | ND | ND |
| San Joaquin River at Patterson | 15-Feb-05 | 08:40 | ND | (0.010 J) | ND | 0.022 | ND | ND | ND | ND |
| San Joaquin River at Patterson | 16-Feb-05 | 09:40 | ND | (0.083 J) | ND | 0.061 | ND | ND | ND | ND |
| San Joaquin River at Patterson | 17-Feb-05 | 08:10 | ND | 0.260 | ND | 0.032 | ND | ND | ND | ND |
| San Joaquin River at Patterson | 18-Feb-05 | 08:40 | ND | BL 0.220 | ND | BL 0.023 | ND | ND | ND | ND |

**Appendix 5.** Lab Blank Data

( No pesticides were present at detectable levels. The pesticides include azinphos methyl, bifenthrin, carbaryl, chlorpyrifos, cyanazine, diazinon, dacthal (DCPA), EPTC (Eptam), metolachlor, methidathion, propargite, simazine)

| Date Extracted | Chlorpyrifos Methyl (Surrogate) Recovery |
|---|---|
| 1/28/2005 | 88% |
| 2/1/2005 | 95% |
| 2/1/2005 | 98% |
| 2/16/2005 | 80%* |
| 2/17/2005 | 91%* |
| 2/17/2005 | 96% |
| 2/18/2005 | 81% |
| 2/22/2005 | 68%[16] |
| 2/22/2005 | 73%[17] |
| 2/23/2005 | 93% |
| 2/24/2005 | 92% |
| 2/25/2005 | 88% |
| 2/28/2005 | 89% |
| 3/1/2005 | 85% |
| * Re-injection | |

[16] The surrogate recovery (68% recovery) was outside of the acceptable range for recovery (80-125%) as defined in the QAPP. A re-analysis yielded similar (66%) results. No compounds were detected above the lab LOD. The low recovery was probably due to loss during the concentration step of the extraction procedure. The Lab spike, all samples and matrix spikes had surrogate recoveries within the acceptance criteria. No further action taken by the laboratory.

[17] The surrogate recovery (73% recovery) was outside of the acceptable range for recovery (80-125%) as defined in the QAPP. The low recovery was likely due to an extraction error of not adding salt to the deionized water used for making blanks and spikes. The omission of salt gives the sample a matrix that is different than that of river water. A clean water sample without added matrix gives recoveries since standards are prepared to match the matrix of a river water sample. All surrogate recoveries in the actual samples associated with this QC set were within the acceptance limits of 80 - 125%. The associated batch of samples were all of the samples collected in the San Joaquin Basin on 18 February 2005 and the samples collected from the Feather River, Sacramento Slough (including a duplicate) and the Sacramento River at Veteran's Bridge on 17 February 2005.

**Appendix 6.** Recovery of lab spikes and surrogates

| Date Extracted | Diazinon | Chlorpyrifos | Bifenthrin | Surrogate |
|---|---|---|---|---|
| 1/28/2005 | 98% | 91% | 91% | 94% |
| 2/1/2005 | 101% | 92% | 97% | 100% |
| 2/1/2005 | 93% | 86% | 97% | 84% |
| 2/16/2005 | 103%* | 80%* | NR | 80%* |
| 2/17/2005 | 102% | 86% | NR | 81% |
| 2/17/2005 | 100% | 82% | NR | 97% |
| 2/18/2005 | 111% | 90% | NR | 90% |
| 2/22/2005 | 91% | 81% | NR | 90% |
| 2/22/2005 | 75%[1] | 69%[1] | NR | 66%[1] |
| 2/23/2005 | 107% | 106% | NR | 100% |
| 2/24/2005 | 99% | 92% | NR | 96% |
| 2/25/2005 | 96% | 83% | NR | 92% |
| 2/28/2005 | 100% | 91% | NR | 94% |
| 3/1/2005 | 94% | 93% | NR | 88% |
| * Re-injection | | | | |

[1] The low spike and surrogate recoveries were likely due to an extraction error of not adding salt to the deionized water used for making blanks and spikes. The omission of salt gives the sample a matrix that is very different from that of river water. A clean water sample without added matrix gives recoveries since standards are prepared to match the matrix of a river water sample. All surrogate recoveries in the actual samples associated with this QC set were within the acceptance limits of 80 - 125%. The associated batch of samples were all of the samples collected in the Delta on 17 February 2005.